A MANUAL
OF
MIDWIFERY

For Students and Practitioners

BY

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WHO HAVE FILLED THE OFFICE OF

MASTER OF THE ROTUNDA HOSPITAL

SINCE ITS FOUNDATION,

AND TO WHOSE SKILL AND LEARNING THE DUBLIN SCHOOL

OF MIDWIFERY OWES ITS GREAT

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PREFACE

IN the following work, I have endeavoured to place before my readers, in a single volume, a comprehensive account of the theory and practice of modern obstetrics. In doing so, I have been greatly assisted by the following gentlemen, who have kindly undertaken to deal with those subjects which require a special knowledge of Anatomy, General Medicine, Pathology, or Mental Disease. Dr. T. G. Moorhead has contributed the chapters on Embryology and Anatomy, and the sections on the Phenomena of Pregnancy and on the Anatomy of Contracted Pelvis; Dr. H. C. Drury the chapters on Infectious Diseases and on Organic and Functional Diseases in Pregnancy; Dr. R. J. Rowlette the sections on the Ætiology and Pathology of the Surgical Fevers of the Puerperium; and Dr. W. R. Dawson the sections on the Insanities of Reproduction. I think that the special knowledge which has been thus brought to bear on these subjects will add very largely to the value of the book.

Dr. William Neville had undertaken the task of writing the chapter on the Surgical Fevers of the Puerperium—a task for the discharge of which his wide knowledge, both of practical obstetrics and of pathology and bacteriology, rendered him particularly suitable. His sudden and premature death has deprived me of the assistance he had promised, and has lost to the Irish School of Midwifery one of its most brilliant workers and original thinkers.

The illustrations throughout the book have been the subject of great care. Most of them are original, and for these I am indebted to Mr. J. T. Murray, Mr. S. Sewell, and Dr. R. H. Kennan. The drawings of the mechanism of labour, and of the obstetrical operations, were made from photographs taken for me by Dr. Arthur Ball, for whose assistance I am very grateful. I am specially indebted to the late Dr. Milne Murray, whose premature death was a grievous loss, not alone to his own Edinburgh School, but to the whole obstetrical world, for permission to make, from his well-known collection, the drawings and diagrams which appear in the chapters upon contracted pelvis. I am also indebted to Professors Bumm of Halle, Whitridge Williams of Baltimore, and Webster of Chicago, for permission to reproduce several valuable original drawings, and to several other authors for a similar privilege.

Professor E. H. Bennett and Professor White have most kindly afforded me every facility for making use of the valuable material collected in the Museums of Trinity College, Dublin, and of the Royal College of Surgeons in Ireland, and thus I have been able to include illustrations of several valuable specimens that are contained in these collections.

The chapters on Ante-partum Hæmorrhage, Post-partum Hæmorrhage, and Eclampsia have already appeared in a slightly different form in the 'Encyclopædia Medica,' published by Messrs. Green and Sons, of Edinburgh, to whom I am indebted for permission to reproduce them.

My colleague, Dr. T. P. C. Kirkpatrick, has most kindly assisted me in reading the proof-sheets, and in many other ways.

HENRY JELLETT.

61, LOWER MOUNT STREET,
MERRION SQUARE, DUBLIN.

April, 1905.

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PART I

OBSTETRICAL ANATOMY—MATERNAL AND OVULAR

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CHAPTER I

THE ANATOMY OF THE BONY PELVIS

The Pelvic Bones: The Sacrum; The Coccyx; The Ossa Innominata—The Pelvis as a Whole: The Inlet; The Outlet; The Cavity; The Diameters of the Pelvis; The External Measurements of the Pelvis; Axis of the Pelvis; Inclined Planes of the Pelvis; The Joints and Ligaments; The Obliquity of the Pelvis—Transmission of Body-weight—Differences between the Male and the Female Pelvis—The Development of the Pelvis.

IN both sexes, the pelvis may be regarded as a bony framework for the attachment of the muscles and ligaments which unite the lower limbs to the trunk, and as an arch which transmits, in a manner adapted to economize muscular energy, the weight of the entire body to the lower limbs, and thence to the ground. It also serves to protect the viscera contained within its cavity, and in some degree to support the abdominal viscera. In the female, it has the additional function of forming a semi-rigid canal, through which the child must pass in the process of parturition, and associated with this function there are several important points of distinction between the male and female pelvis. It is chiefly in relation to the mechanism of parturition that a study of pelvic anatomy is of importance to the obstetrician.

THE PELVIC BONES.—The pelvis is made up of four bones—the sacrum, the coccyx, and the two ossa innominata. Above, it is connected with the vertebral column by the articulation of the sacrum with the fifth lumbar vertebra, and below, it is supported upon the heads of the femora.

The Sacrum.—The sacrum is composed of three main portions:—a central part formed by the fusion of the bodies of the five sacral vertebræ; and two lateral masses. The lateral masses constitute those portions of the bone which lie external to the anterior sacral foramina. They are developed from three or more distinct osseous centres on each side, and are at first separated from the central portion by a thin layer of cartilage, but become completely fused with it before the twenty-fifth year of life. The bone is principally composed of cancellous tissue, and is triangular in shape, with its base directed upwards and forwards, and its apex downwards and forwards. The anterior surface is smooth, concave from above downwards, and slightly so from side to side, and presents faint transverse ridges or depressions which mark the original line of separation between the individual sacral vertebræ.

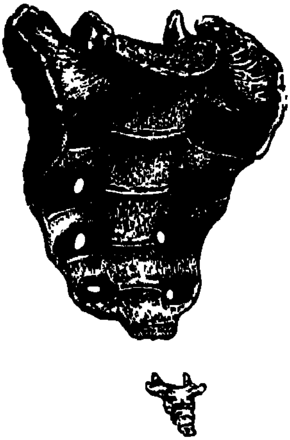

FIG. 1.—SACRUM AND COCCYX.

Its width at the base is about 4½ inches, and at the apex about 2 inches. The posterior surface is irregular, presenting a median ridge formed by the spines of the sacral vertebræ, and is bounded

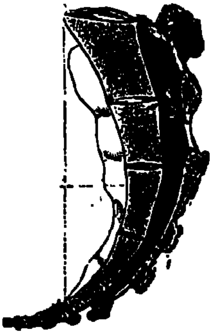

FIG. 2.—A LONGITUDINAL MESIAL SECTION THROUGH THE SACRUM AND COCCYX.

on either side by a vertical ridge composed of the sacral transverse processes. It is of less extent than the anterior surface and is convex both in the vertical and transverse directions. I gives attachment to some of the muscles of the back. The latera surface presents at its upper part an anterior cartilage-covered surface, which articulates with the ilium,* and behind this there is a rough, irregular area for the attachment of the posterior sacro-iliac ligaments. Inferiorly, the narrow margin which represents this surface gives attachment to the sacro-sciatic ligaments. The base of the bone has the ordinary appearance of the upper aspect of a lumbar vertebra, flanked on each side by the prominent alæ, and the apex articulates with the first bone of the coccyx.

2 **The Coccyx.**—The coccyx lies immediately below the sacrum, and continues the curve of that bone. With the exception of its first piece, which possesses a well-defined centrum and transverse processes, it is represented by from three to five rudimentary bony nodules, which rarely become united to one another by osseous union before middle life. In consequence of this, the coccyx is freely movable in a forward and backward direction around the end of the sacrum, and the individual pieces also move upon one another. Occasionally, however, premature union of the various parts and of the first part with the sacrum does occur, and may prove a source of some difficulty during the expulsion of the child.

3 **The Os Innominatum.**—This bone is developed in a bar of cartilage which appears on each side of the lower portion of the vertebral column at an early period of fœtal life, and which in most mammalia bends round to meet its fellow of the opposite side in the middle line in front. In each bar of cartilage, ossification proceeds in such a way as to produce three distinct bones—the ilium, the ischium, and the os pubis. At birth, these are still quite distinct from one another, being united at the bottom of the acetabulum by a Y-shaped piece of cartilage, in which several osseous centres appear at different periods after birth, and finally bring about the union of the different parts at about the twentieth year. The complete bone is divided into an upper and a lower portion by means of a prominent ridge situated on its inner aspect, and called the *ilio-pectineal line*. The portion of bone above this line is the broad expanded part of the ilium, and is called the *ala ilii*. It is bounded superiorly by a strong curved margin—the *crista ilii*—which terminates in front and behind in the anterior superior and posterior superior iliac spines respectively. The crest gives attachment to the flat abdominal muscles, which play such an important auxiliary part to the contractions of the uterus during labour, while to the outer aspect of the ala are attached the gluteal muscles which form the principal mass

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* The lateral articular surfaces of the sacrum are usually asymmetrical. Most frequently the right surface is more deeply concave than the left, and is more overlapped by an anterior projecting lip of the ilium. The general appearance suggests that more mutual moulding of sacrum and of ilium has occurred on this side, and the fact is of interest in connection with the transmission of the body-weight.

of the buttock. Below this line the bone is principally formed by the ischium and os pubis, between which there exists anteriorly a wide foramen—the thyroid or obturator foramen. This is, in the fresh state, filled in by a firm membrane, which gives origin from its inner aspect to the obturator internus muscle and from its outer aspect to the obturator externus.

THE PELVIS AS A WHOLE.—The pelvis as a whole, formed by the articulation of these different bones, is divided into an upper or *false pelvis*, and a lower or *true pelvis*, along a plane passing through the sacral* promontory and the ilio-pectineal lines. The part which lies above this plane belongs to the abdomen proper, and forms a considerable part of the posterior and lateral boundaries of that cavity. It also affords support to many of the abdominal contents. It is formed on each side by the broad expanded portion of the os ilii, covered in the recent state by the iliacus muscle and by the psoas. The latter muscle runs along the inner border of the iliac fossa, just above the ilio-pectineal line, and, indeed, slightly overlaps it. The false pelvis is deficient in front, the space between the bones being filled up by the anterior abdominal wall. The part which lies below this plane is known as the *true pelvis*. It is bounded posteriorly by the sacrum and coccyx, laterally by the body of the ischium and by a small portion of the ilium, and in front by the ramus of the ischium and by the pubis. It forms a bony cavity containing the pelvic

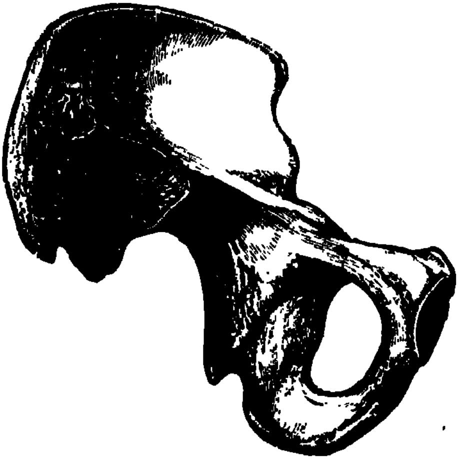

FIG. 3.—OS INNOMINATUM.

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* The promontory of the sacrum is not quite in the same plane as the ilio-pectineal lines and their continuation along the sacral alæ, but lies at a slightly higher level. The difference, however, is so slight that for practical purposes it may be regarded as non-existent.

viscera, and constitutes the firm boundary of the canal through which the child must pass in parturition. It will be described under three headings—the inlet, the outlet, and the cavity.

1 **The Pelvic Inlet.**—The inlet of the pelvis is formed by the boundaries of the plane which separates the true from the false pelvis. Commencing in front, it is bounded on each side by the symphysis pubis, the crest and inner margin of the horizontal ramus of the pubis, the ilio-pectineal eminence, the ilio-pectineal line, and the anterior margin of the base of the sacrum. In man, all these points, with the exception of the promontory of the sacrum already referred to, are approximately situated on the same plane, but in other mammalia there is a distinct angle (ilio-pubic angle) formed anteriorly between the ilium and the os pubis by a bending upwards of the ramus of the pubis at the ilio-pectineal eminence. In consequence of this, in all mammalia but man, the lateral portion of the boundary of the inlet lies below the level of a line drawn from the symphysis pubis to the base of the sacrum. Owing to a slight forward projection of the sacral promontory, the inlet is somewhat heart-shaped.

2 **The Pelvic Outlet.**—The outlet of the pelvis is bounded from before backwards by the symphysis pubis, the lower margin of the body and descending ramus of the pubis, the ramus of the ischium, the tuber ischii, the great sacro-sciatic ligament, and the tip of the coccyx on each side. It is usually described as lozenge-shaped, the lozenge being formed of two triangles which have a common base represented by an imaginary line drawn transversely between the tubera ischii. The apex of the posterior triangle is situated at the tip of the coccyx, and that of the anterior at the lower margin of the symphysis pubis. In front, the under-surface of the symphysis is rounded off by the sub-pubic ligament. As compared with the inlet, the outlet is obviously capable of great variations in size, since it is partially bounded by ligamentous structures and partially by the movable coccyx.

3 **The Pelvic Cavity.**—The cavity of the pelvis is the space contained between the plane of the inlet and the outlet. Posteriorly, it is bounded by the sacrum and the coccyx, and is in vertical depth about 4½ inches in the female. Anteriorly, it is bounded by the posterior surface of the symphysis pubis, and is only 1½ inches deep. Laterally, it is bounded by the body of the ischium, which is 3½ inches deep. It is thus seen that the cavity becomes progressively more shallow from behind forward. Posteriorly, on each side a large gap, the sciatic notch, is left between the side of the sacrum and the ischium. This space is partially filled in by the sciatic ligaments, but superiorly gives egress to the vessels and nerves which pass from the pelvis into the gluteal region, and also to the tendon of the pyriformis muscle. On its inner aspect it is covered over by the parietal layer of pelvic fascia. Anteriorly, the obturator foramen forms a wide gap on each side between the ischium and pubis.

On looking at the pelvis it will be noticed that the anterior boundary is flat, but that the posterior is curved, with the concavity directed forwards and downwards, and that this curvature of the sacrum and coccyx gives the entire cavity a marked bend, which in its great extent is a distinguishing human characteristic. The difficulty experienced in parturition by the head of the child having to follow this bend is somewhat compensated for by the great shallowness of the cavity, which shallowness forms another characteristic difference between the human pelvis and that of other mammalia.

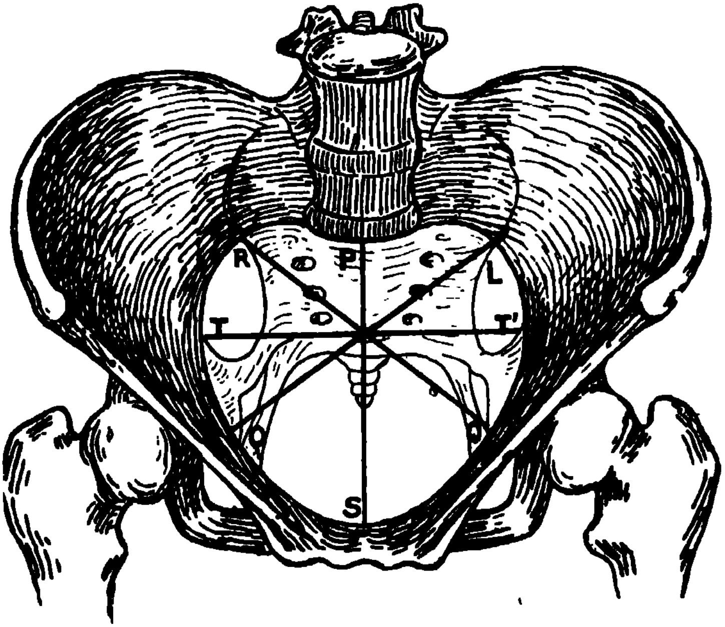

Fig. 4.—Brim of Female Pelvis, showing Diameters.

P.S., Conjugate diameter; T.T′., transverse diameter; R.O., right oblique diameter; L.O., left oblique diameter.

4 **Diameters of the Pelvis.**—An accurate idea of the dimensions of the pelvis is best conveyed by stating the length of certain lines drawn between opposing points of the wall in any given plane. These lines are known as the diameters of the pelvis, and in each plane three principal diameters are described—the antero-posterior or conjugate, the transverse, and the oblique. From an obstetrical standpoint, the most important planes to be considered are those of the inlet and outlet, as, speaking generally, these are more contracted than the intervening ones, and, therefore, afford a greater obstacle to the passage of the child.

Diameters of the Inlet.—The antero-posterior or conjugate diameter stretches from the promontory of the sacrum to the upper margin of the symphysis pubis, and measures, on an average, 4½ inches (11 centimetres). This diameter is frequently called the conjugata vera[*] to distinguish it from the false conjugate or conjugata diagonalis, which is measured from the sacral promontory to the under margin of the symphysis, and which exceeds the former by about half an inch in length.

The transverse diameter is the greatest distance between the two ossa innominata in the coronal plane, and measures about 5⅛ inches (13 cm.). It cuts the antero-posterior diameter nearer to the sacrum than to the pubis, but lies further forward in the female than in the male, owing to the greater hollowing out of the os innominatum in the female sex. As compared with other mammalia, the excess in length of the transverse over the antero-posterior diameter is a striking human characteristic.

The oblique diameter is drawn from the upper margin of the sacro-iliac joint to the inner aspect of the opposite os innominatum at the level of the ilio-pectineal eminence. The right oblique diameter commences at the right sacro-iliac joint, and extends forwards and to the left; the left oblique diameter, commencing at the left sacro-iliac joint, ends at the right ilio-pectineal eminence. Each of these diameters measures about 5 inches (12·5 cm.), but it is rare to find them absolutely equal in length, the right, perhaps, being the longer in the majority of individuals.

The oblique diameter, as above described, is anatomically convenient, since it is drawn between two easily determined points of the pelvis; but since it cuts the conjugate diameter nearer to the promontory than to the symphysis, it does not accurately represent the central oblique diameter in which the head of the child engages. The true central oblique diameter measures slightly under 5 inches, and is indicated by a line drawn from a point a finger's breadth in front of the ilio-pectineal eminence backwards through the centre of the conjugata vera to cut the pelvic brim slightly anterior to the sacro-iliac articulation.

Another measurement is also usually given in describing the pelvic brim, and is called the sacro-cotyloid. It extends from the sacral promontory to a point on the brim corresponding to the upper margin of the acetabulum. It measures about 3⅜ inches (8½ centimetres), and is of value in defining the extent of the posterior concavity of the pelvis at each side.

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[*] A distinction is sometimes drawn between the conjugata vera and the obstetrical conjugate, the latter being the line drawn from the promontory of the sacrum to the nearest point of the symphysis pubis. This distinction is of some importance in those pelves in which there is a well-developed elevation on the posterior aspect of the upper part of the symphysis (retro-pubic eminence); but in most pelves, in which this eminence is small, the obstetrical may be regarded as identical with the true conjugate.

The lengths of the various diameters of the brim, as given above, are measured on the macerated pelvis, and it must, consequently, be remembered that during life a small amount must be deducted owing to the presence of the soft parts. This remark is especially true in relation to the transverse diameter, which is diminished by at least half an inch by the overlapping of the psoas muscles on each side, in consequence of which the oblique diameter of the brim during life comes to be the longest of the three principal diameters.

The circumference of the brim measures, on an average, from 16 to 17 inches (40 to 43 centimetres) in the macerated pelvis.

Diameters of the Outlet.—The antero-posterior diameter of the outlet extends from the tip of the coccyx to the lower margin of the symphysis pubis. It measures 3¾ inches (9·5 centimetres), but can be increased by nearly an inch by extension of the coccyx, so that when that bone is bent backwards it attains a length of 4⅜ inches (11·5 centimetres).

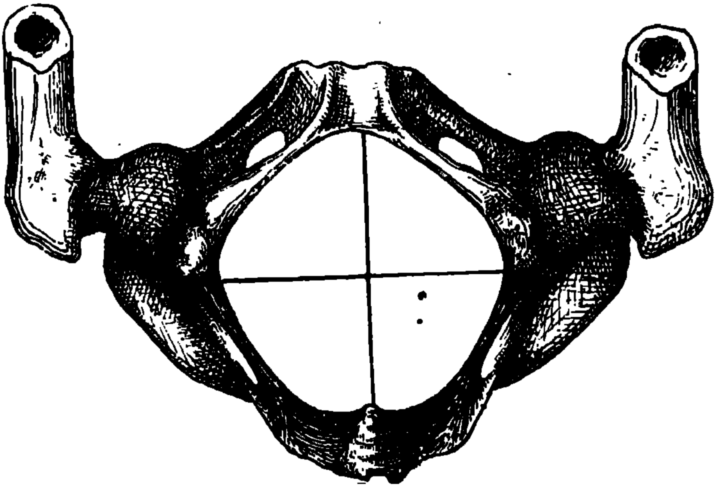

FIG. 5.—OUTLET OF PELVIS, SHOWING DIAMETERS.

The transverse diameter, 4⅜ inches (11 centimetres) in length, is measured between the widest parts of the tubera ischii, below and in front of the ischial spines (*pre-épineux*). The distance between the spines themselves (*inter-épineux*) is about half an inch less. The former measurement is, however, much the more important in normal pelves, since the head of the child passes downwards in front of, rather than between, the spines of the ischia. The presence of the obturator internus muscle causes some diminution in the transverse diameter of the outlet during life.

The oblique diameter of the outlet is not of much importance. It is drawn between the middle of the inferior border of the great sacro-sciatic ligament to the junction of the rami of the ischium and pubis on the opposite side. It measures about 4⅜ inches (11 centimetres), but is capable of considerable elongation due to stretching of the sacro-sciatic ligament. The circumference of the outlet measures about 13⅜ inches (34 cm.), and is capable of considerable increase from the effects of a dilating force.

Diameters of the Cavity.—Within the cavity itself two planes may be taken as representative, and since they mark respectively the place of greatest and of least pelvic circumference, they may be called respectively the plane of greatest expansion and the plane of greatest contraction.

The plane of greatest expansion lies between the mid-point of the posterior surface of the symphysis and the junction of the bodies of the second and third sacral vertebræ. It passes across the ischium at the middle of the inner surface of the acetabulum. The conjugate diameter here measures nearly 5 inches (12·5 centimetres), and the transverse 4¾ inches (12 cm.).

The plane of greatest contraction is contained between the sacro-coccygeal joint and the junction of the middle and lower third of the symphysis. Included within it are the ischial spines. The conjugate here measures 4⅛ inches (10·5 centimetres), and the transverse 4 inches only (10 cm.). This plane obviously forms the true obstetrical outlet of the pelvis.

The above measurements may be summarized in the following table:—

	Conjugate.	Transverse.	Oblique.
Brim	4¼ inches (11 cm.)	5¼ inches (13 cm.)	5 inches (12·5 cm.)
Plane of greatest expansion	5 inches (12·5 cm.)	4¾ inches (12 cm.)	—
Plane of greatest contraction	4⅛ inches (10 5 cm.)	4 inches (10 cm.)	
Outlet	3¾ to 4⅞ inches (9 5 to 11·5 cm)	4⅜ inches (11 cm)	4⅜ inches (11 cm.)

When these figures are examined, it is seen that the conjugate diameter becomes considerably increased in length immediately beneath the sacral promontory, on account of the vertical concavity of the sacrum. This increased length it retains till the sacro-coccygeal joint is reached, where it becomes somewhat suddenly narrowed; but, at the anatomical outlet it has more than regained its original length, on account of the mobility of the coccyx. The transverse diameter, on the contrary, becomes progressively smaller from above downwards, and thus gives to the whole pelvis a slightly funnel-shaped appearance. The only really important oblique measurement is that of the brim, as elsewhere one of its boundaries is formed by soft parts, which render it capable of great expansi[illegible] under pressure. The changes in relative length of the conjuga[illegible] and transverse diameters in passing through the pelvic cylinder are probably of prime importance in determining the course which the head of the child takes. At the inlet least resistance is experienced in the transverse or oblique diameter, and consequently the head of the child enters in this direction. As it passes downwards, however, the transverse resistance increases, while the antero-posterior diminishes, not only on account of the greater length of the conjugate diameter, but also owing to the relative shallowness of the anterior boundary of this diameter, and hence the head of the child turns round and passes along the direction of least resistance.

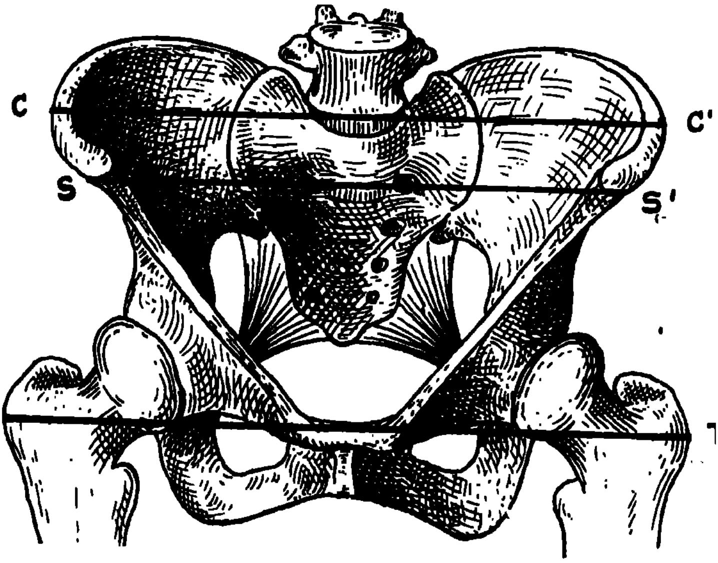

FIG. 6.—FRONT VIEW OF PELVIS.
CC', Iliac crests; SS', anterior superior iliac spines; TT', great trochanters.

The preceding pelvic measurements must be regarded as being merely the average of a large number of cases, since, as has been already stated, they are subject to great individual differences, which depend partly, at any rate, on the general size and development of the body as a whole. There are, moreover, marked racial differences, and it has been shown that there is a coincidence between the prevailing form of the fœtal skull and the shape of the pelvis. In the lower races, the ratio between the length of the conjugate and transverse diameters of the brim may vary widely from that given above, and the conjugate diameter may equal, or even exceed, the transverse.

5 **External Measurements of the Pelvis.**—In addition to the internal diameters of the true pelvis, there are certain external measurements of both the true and the false pelvis which are of considerable importance, inasmuch as they can at all times be readily determined during life, and thus supply an easy mode of diagnosing the more pronounced forms of pelvic deformity. The more important are as follows:—

(1) The inter-spinous distance—*i.e.*, the distance between the two anterior superior iliac spines. This measures, as a rule, about 10½ inches (26·5 centimetres), and is always in normal pelves less than the distance between the iliac crests.

(2) The inter-cristal distance—*i.e.*, the distance between the widest parts of the iliac crests. This measures from 11 to 11½ inches (28 to 29 centimetres).

(3) The external conjugate diameter, measured from the spinous process of the last lumbar vertebra to the upper margin of the symphysis pubis, averages 8 inches (20 centimetres).

(4) The inter-trochanteric distance, taken between the summits of the great trochanters, measures 12½ inches (31 centimetres).

(5) The distance between the posterior superior iliac spines is about 3½ inches (9 centimetres).

6 **Axis of the Pelvis.**—There is considerable difficulty in defining the exact axis of the pelvis, since the pelvic cavity, though approaching to the form of a curved cylinder, is very irregular; and it may at once be stated that the mode of determining the axis which is given below is not altogether accurate. It, however, defines with considerable precision the path along which the head of the child moves during parturition.

The axis of any given plane of the pelvis is a line drawn perpendicularly to it at its central point, and, equidistant from every part of its circumference, assuming the plane to be the section of a sphere. Since it is impossible to determine the exact centre of any plane, however, it becomes necessary to adopt as a working centre the point of bisection of some given line lying in the plane. At the brim, the middle of the conjugata vera is selected. A line drawn at right angles to it represents the axis of the brim, and would, if produced, cut the abdominal wall at the level of the umbilicus above, and below would strike the inferior extremity of the coccyx. Now, the symphysis pubis may be regarded as being parallel to the upper two sacral vertebræ, and is nearly of the same vertical depth; and therefore the part of the pelvic cavity which is enclosed between the plane of the brim and a plane extending between the lower margin of the symphysis and the junction of the second and third sacral vertebræ may be looked upon as forming a short cylinder, whose axis will be identical with the axis of the plane of the brim. The axis of every plane in this cylinder will then be represented by that portion of the prolonged axis of the brim which is contained within the cylinder.

The axis of the outlet is determined in a similar manner to that of the brim, by drawing a line at right angles to the mid-point of its conjugate diameter. This line, when prolonged upwards, strikes the sacral promontory when the coccyx is in its normal position, but when the coccyx is extended it meets the sacrum at a much lower level.

The axes of the upper portion of the pelvis and of the outlet are thus readily determined. The axis of the intermediate portion will be represented by joining the central points of a series of closely succeeding planes contained within it, and is best determined as follows:—Prolong the conjugate diameters of the inlet and of the outlet till they meet anteriorly, and from the point of intersection draw a series of lines to the sacrum and coccyx below the second sacral vertebra. Bisect that portion of each of these lines which is contained between the anterior and posterior pelvic walls, and join the points of bisection to one another. A curved line is thus drawn, the extremities of which are to be joined to the centre of the outlet below and to the axis of the upper part of the pelvis above, when the complete line will represent the axis. This line is, to quote Ward,* 'a more or less irregular parabolic curve, the concavity of which is directed forwards, passing from the fixed axis of the brim, and movable forwards at its inferior extremity, with the movable axis of the outlet with which it corresponds below.' It is directed at first backwards and down-

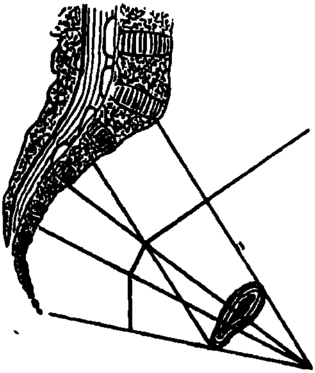

FIG. 7.—DIAGRAM TO SHOW THE METHOD OF DETERMINING THE PELVIC AXIS. (For description, see text.)

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* Todd's 'Cyclopædia of Anatomy and Physiology,' vol. v., p. 134 *et seq.*

wards, then directly downwards, and, finally, forwards and downwards.

Inclined Planes of the Pelvis.—The cavity of the true pelvis is roughly divisible into two segments—an antero-inferior and a postero-superior. The dividing-line between these two parts is formed by a faint ridge of bone which extends on the inner surface of each os innominatum, from the spine of the ischium upwards and forwards to the upper portion of the obturator foramen. The parts of the pelvic wall which lie anterior to this ridge are known as the anterior inclined planes of the pelvis because they slope downwards and forwards to the sub-pubic arch; the portions of the wall posterior to the ridge are called the posterior inclined planes, and slope backwards and downwards towards the concavity of the sacrum. These planes are supposed to help in determining the different rotations of the fœtal head which occur during parturition, but it is probable that their importance has been exaggerated.

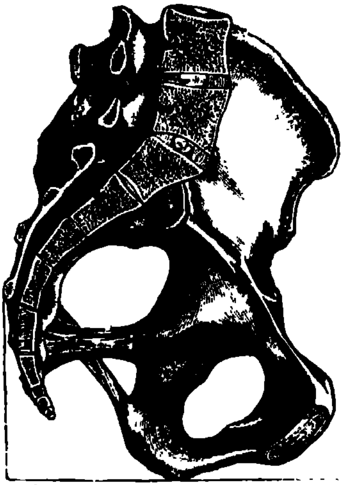

FIG. 8.—LATERAL VIEW OF INTERIOR OF PELVIS, SHOWING THE INCLINED PLANES AND THE SACRO-SCIATIC LIGAMENTS. THE NORMAL OBLIQUITY IS ALSO REPRESENTED. (Naegele.)

Joints and Ligaments of the Pelvis.—*Sacro-iliac Joint.*—The sacrum articulates on each side with the posterior portion of the inner surface of the ilium, forming the sacro-iliac joint. The opposed surfaces of both bones are covered with a thin layer of hyaline cartilage, and are somewhat irregular. These cartilaginous plates are, usually in the male, and in both sexes in old age, directly connected together by bands of fibrous tissue, and hence the common application of the term 'synchondrosis' to the articulation. In young females, however, and especially towards the end of pregnancy, a distinct joint cavity exists, and is surrounded by a delicate synovial membrane. In front of the joint, a weak and unimportant ligament, called the anterior sacro-iliac, stretches between the pelvic surfaces of the ilium and the sacrum, and serves to round off the irregularity of the interior of the pelvis caused by the articulation. On the posterior aspect of the joint, the posterior sacro-iliac ligament, composed of stout bundles of fibrous tissue, stretches between the rough surfaces of the ilium and the sacrum which lie behind the articular surfaces. Many of these fibres are directed downwards and inwards from the ilium, and one band in particular (the oblique sacro-iliac ligament) passes from the posterior superior iliac spine to the transverse processes of the second and third sacral vertebræ. Above, the joint is

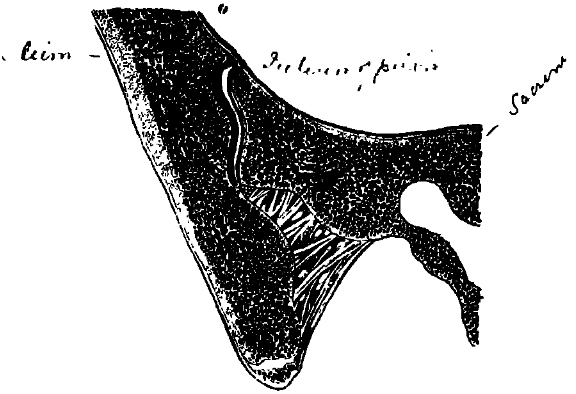

FIG. 9.—SECTION THROUGH THE LEFT SACRO-ILIAC ARTICULATION. (Luschka.)

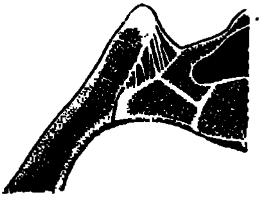

FIG. 10.—SECTION THROUGH SACRO-ILIAC JOINT IN A FŒTAL PELVIS, SHOWING THE ATTACHMENT OF THE POSTERIOR SACRO-ILIAC LIGAMENT.

The lateral portion of the sacrum is also seen separated from the remainder of the bone by cartilage. (Farabœuf.)

covered over by a few transverse fibres continuous with the lumbo-sacral ligament, and below it is closed in by the superior attachment of the sacro-sciatic ligaments.

Sacro-coccygeal and Inter-coccygeal Joints.—The articulation of the sacrum and the coccyx is similar to the joints found elsewhere between the bodies of the vertebræ, but, as a rule, allows of much freer movement. According to Lüschka, there is a definite synovial membrane[*] present in the intervertebral disc, and this enables the coccyx to move backwards and forwards freely upon the apex of the sacrum. This movement is normally limited by the attachment of the sacro-sciatic ligaments to the side of the coccyx, and the relaxation of these ligaments, which takes place towards the end of gestation, greatly increases the mobility of the bone. The transverse processes and cornua of the first coccygeal vertebra are also connected to the sacrum by short ligaments.

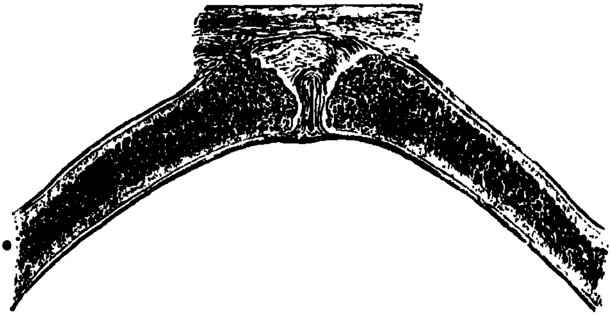

FIG. 11.—TRANSVERSE SECTION THROUGH SYMPHYSIS PUBIS, SHOWING THE ANTERIOR PUBIC LIGAMENT AND THE SYNOVIAL CAVITY IN THE INTER-ARTICULAR DISC. (Lusk.)

The bony nodules of the coccyx are united to one another by discs of fibro-cartilage and by anterior and posterior ligaments.

Lumbo-sacral Articulation.—The base of the sacrum articulates with the under-surface of the body of the fifth lumbar vertebra, forming with it a very distinct angle projecting forwards, which is called the sacro-vertebral angle or sacral promontory. In addition to the normal ligaments of the vertebral column—namely, the intervertebral disc, the anterior and posterior common ligaments, and the ligamenta subflava—there are two accessory ligaments on each side belonging to this articulation, which from their points of attachment are called respectively the *lumbo-sacral* and *ilio-lumbar* ligaments. The former of these is fan-shaped, and passes from the lower border of the transverse process of the fifth lumbar vertebra to the ala of the sacrum. The ilio-lumbar passes from the tip of the transverse process of the same vertebra backwards and outwards to the posterior part of the iliac crest.

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[*] Sometimes the synovial cavity is very distinct, and is co-extensive with the articulating surfaces of the bones.

(5) *Symphysis Pubis.*—The bodies of the two pubic bones articulate with one another by their inner surfaces closing the pelvic ring anteriorly, and forming a joint known as the symphysis pubis. The opposed bony surfaces are each covered with a thin layer of hyaline cartilage, between which there pass strong bands of fibro-cartilage, and among these, at the upper and posterior part, a small synovial cavity can occasionally be demonstrated.

On the anterior and posterior surfaces of the articulation, there are present ligaments the fibres of which pass transversely. Of these two ligaments, the anterior is much the stronger, and is partially blended with the lower tendinous fibres of the rectus abdominis muscle. A weak supra-pubic ligament unites the bones above, and below there is a strong sub-pubic ligament which in the middle line is triangular in vertical section, and rounds off the inferior aspect of the joint. Its fibres extend for a considerable distance downwards on the rami of the pubis and ischium.

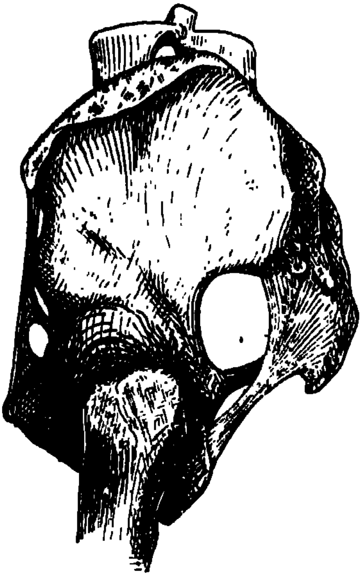

FIG. 12.—LATERAL VIEW OF EXTERIOR OF PELVIS, SHOWING PELVIC OBLIQUITY AND THE SCIATIC LIGAMENTS.

(6) *The Sacro-sciatic Ligaments.*—The great sacro-sciatic ligament bounds the lower portion of the pelvic cavity on its postero-lateral aspect, and partially fills up the gap which exists between

the side of the sacrum and the posterior border of the ischium. Above, it is attached by a wide border to the posterior inferior iliac spine and to the side of the sacrum and coccyx. Below, it is narrower, and gains attachment to the inner lip of the tuber ischii, sending forwards a prolongation, known as the falciform process, on the inner side of the ramus of the ischium, which blends above with the lower margin of the sub-pubic ligament. The small sacro-sciatic ligament is triangular in shape, and lies on a plane anterior to the great sacro-sciatic ligament. It is attached above by its base to the side of the sacrum and coccyx, and below by its apex to the spine of the ischium. These ligaments are normally quite tense, and serve to limit the independent backward movement of the coccyx upon the sacrum, and also to restrain the movement of the sacrum around its transverse axis.

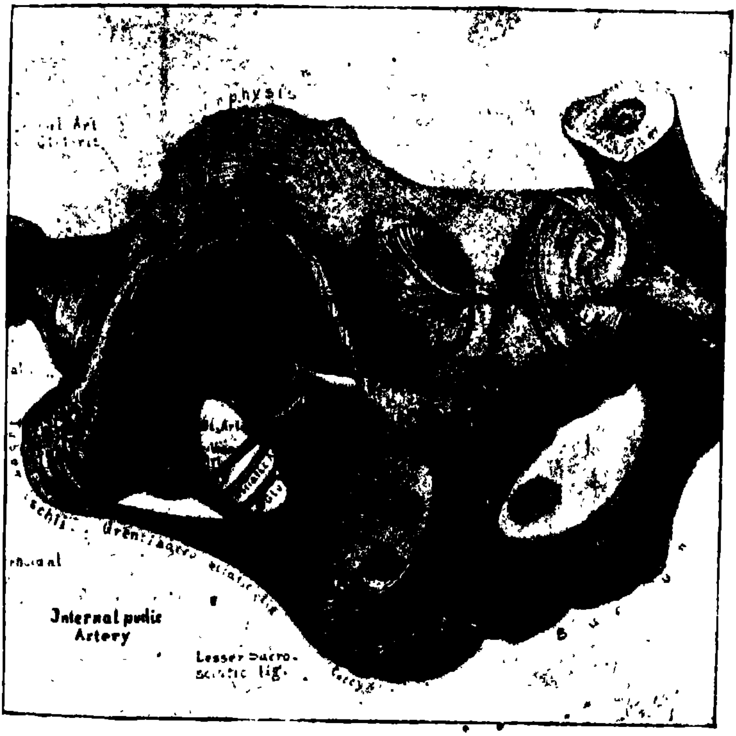

FIG. 13.—OUTLET OF PELVIS, SHOWING LIGAMENTS. (Kelly.)

Obliquity of the Pelvis.*—In most of the lower mammalia, the plane of the pelvic brim is placed almost at right angles to the long axis of the body, and for long it was thought that the same relation existed in man. In fact, it was supposed that when man assumed the erect position the pelvis swung round through an angle of 90° upon the heads of the femora, and carried the trunk with it. That this relation does not exist was first demonstrated by Naegele,† and since his researches it has been known that the plane of the pelvic brim forms an obtuse angle, opening upwards, with the body axis, and that man has become erect partly by the swinging round of his pelvis, which, however, is prevented from passing through an angle of more than 30° by the ilio-

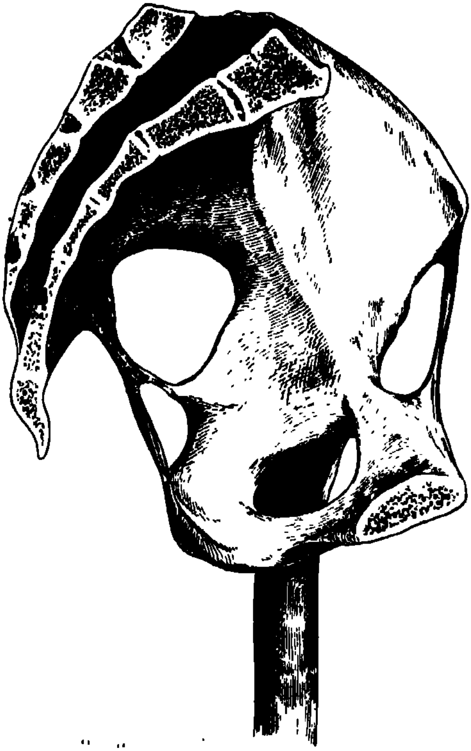

FIG. 14.—THE INCLINATION OF THE PELVIS.

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* The following remarks upon the inclination of the pelvis refer entirely to the position which it occupies when the individual is standing erect. The inclination will obviously vary with change of position of the body.

† Naegele, 'Das Weibliche Becken.' 1825.

femoral ligaments, and partly by the development of curvatures in his vertebral column.

The angle formed by the plane of the pelvic brim with the plane passing through the horizon is on an average about 60° (150° with the body axis), but varies somewhat in different individuals, and is less in the female than in the male. It varies also with changes in the position of the lower limbs and with variations in the position of the centre of gravity of the body. In fact, any cause which tends to relax the ilio-femoral ligaments will also produce a diminution in the obliquity. Normally, these ligaments are tightly stretched, owing to the fact that the centre of gravity of the body lies slightly posterior to the acetabula; but if the centre of gravity of the body becomes shifted forwards, as, for example, occurs in pregnancy, the ligaments are relaxed and the obliquity becomes somewhat diminished.

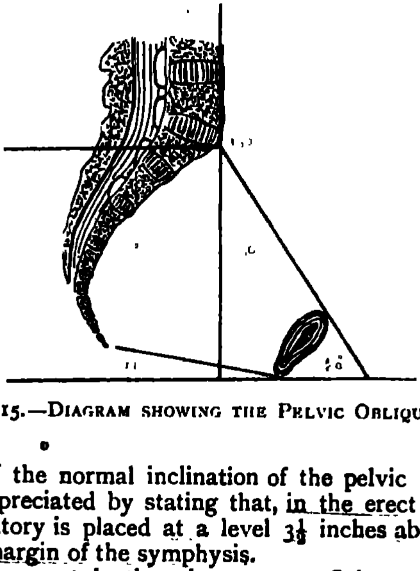

FIG. 15.—DIAGRAM SHOWING THE PELVIC OBLIQUITY.

The extent of the normal inclination of the pelvic brim will be more fully appreciated by stating that, in the erect posture, the sacral promontory is placed at a level 3½ inches above the level of the upper margin of the symphysis.

Owing to the great depth and curvature of the posterior pelvic wall as compared with the anterior, the plane of the pelvic outlet is not parallel with that of the inlet, and its inclination is therefore not the same. If both planes were prolonged forwards they would meet in front, about one and a half inches anterior to, and slightly below, the symphysis pubis. The tip of the coccyx lies about half an inch above the lower margin of the symphysis, and the line joining these two points, which is taken as representing the plane of the outlet, forms with the horizonal plane an angle of 10° or 11°. When the coccyx is extended, this angle is diminished, and the conjugate diameter of the outlet may then coincide with the horizon.

TRANSMISSION OF THE BODY-WEIGHT. — Considered as the medium through which the body-weight is transmitted to the lower limbs, the pelvis may be regarded as being composed of a posterior and an anterior arch.

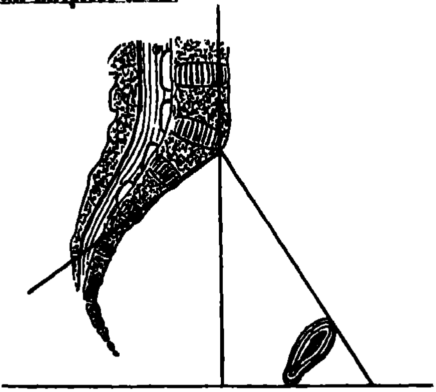

FIG. 16.—DIAGRAM TO ILLUSTRATE DESCRIPTION OF THE TRANSMISSION OF THE BODY-WEIGHT.

The posterior arch constitutes that portion which lies behind the acetabula, and is the only portion which is directly concerned in supporting the weight of the trunk. This weight is transmitted differently, according as the individual is in the standing or sitting

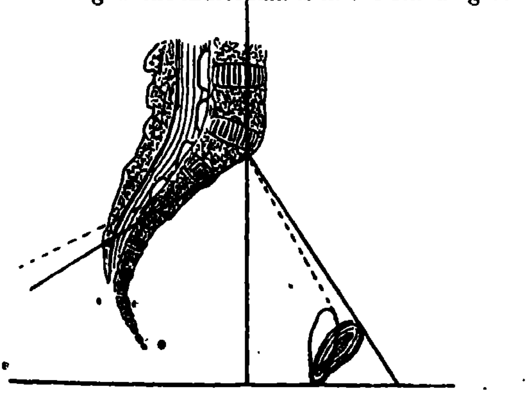

FIG. 17.—DIAGRAM TO SHOW THE VARIATIONS IN THE AMOUNT OF THE BODY-WEIGHT TRANSMITTED ALONG THE DIFFERENT PLANES DEPENDENT UPON CHANGES IN THE PELVIC OBLIQUITY.

posture. When standing, the supporting arch (sacro-cotyloid) is formed by the sacrum, the acetabula, and the strong beams of the ilia, which extend between the acetabula and the auricular surfaces of the bones; and, when sitting, it is composed of the sacrum, the tubera ischii and the bone which extends between these parts (ischio-sacral arch).

The anterior, or pubic, arch unites the anterior extremities of the two segments (sacro-cotyloid and ischio-sacral) of the posterior arch, and forms a strong tie-beam, which binds these extremities in position and prevents them from diverging outwards.

Since the sacrum occupies the centre of the important posterior arch, and is the bone through which the body-weight is transmitted to the ossa innominata, it is important to consider in some detail its articulation with these bones. As already stated, the anterior surface of the sacrum is of greater extent than the posterior, and so great is the difference in transverse width of these surfaces that on section the sacrum appears to be suspended between the two ilia by means of the powerful posterior sacro-iliac ligaments, and to be prevented by them from being pushed forwards by the body-weight into the pelvis. It appears, in fact, as if that component of the body-weight which acts downwards and forwards in the plane of the pelvic brim is, on account of the inverted wedge-shape of the sacrum, entirely counteracted by the posterior sacro-iliac ligaments, and transmitted by their pull to the ilia.

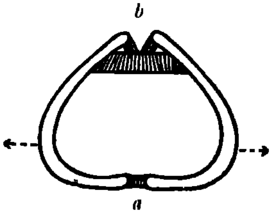

FIG 18.—DIAGRAM SHOWING THE RELATION OF THE SACRUM TO THE OSSA INNOMINATA.

a, Symphysis; *b*, sacrum.

The arrows show where the outward leverage action of the sacro-iliac ligaments is exerted.

Without doubt these ligaments do exercise an important function in this manner, and are the chief media through which the weight of the body, acting through the base of the sacrum, is transmitted to the lateral portions of the arch; but their importance has been somewhat overestimated, for a considerable portion of the weight can be transmitted directly from one bone to the other. This can be proved by an examination of transverse sections made at different levels through the articulation, and by an examination of the fresh surfaces of the bones after disarticulation. By these means the following facts can be observed:—(1) At the upper portion of the articulation a distinct wedge shaped projection of the auricular surface of the sacrum fits into a corresponding depression on the auricular surface of the ilium. This projection varies much in size, and causes a reversal of the general wedge-shaped character of the sacrum—*i.e.*, at its level the sacrum is wider posteriorly than in front. (2) At the anterior part of the joint there is a slight, but distinct, inward lipping of the ilium, which causes the ilium to overlap to some extent the front of the sacral articular surface. The presence of this lip permits of the direct transmission of weight from the sacrum to the femur through the strong connecting-bar of the ilium. The lip does not exist in the fœtal pelvis, and is evidently produced as the result of pressure and counter-pressure when the bones are still plastic. (3) Some locking of the bones is caused by the general irregularity of the opposed surfaces.

When a coronal section of the sacrum is made in the direction of its long axis, it is found that in this direction it forms a true wedge between the iliac bones, the apex of which is below and the base above.* This adaptation of the bones, aided by the suspensory action of the posterior sacro-iliac ligaments, prevents the sacrum being driven downwards and backwards by that component of the body-weight which acts in the direction of its axis (see below).

The centre of gravity of the body is situated just above the sacro-lumbar articulation, nearer to the anterior than to the posterior margin of the body of the first sacral vertebra,† and through this point the resulting force of the body-weight acts vertically downwards upon the base of the sacrum. This force may be resolved into two components, one acting downwards and forwards in the plane of the pelvic brim, and the other downwards and backwards along the axis of the upper portion of the sacrum. (*v.* Figs. 16, 17). The first component tends to drive the sacrum forwards, and, as we have seen, is transmitted to the ilium by the posterior sacro-iliac ligaments and by the interlocking of the bones. The second component tends to drive the sacrum downwards and backwards, and is transmitted to the ilia by the wedge-shaped character of the articulation and by the upper portion of the same ligaments. A constant strain is thus exerted upon the sacro-iliac ligaments, and these, pulling upon that part of the innominate bones that lies posterior to the articulation, as upon the short arm of a lever, tend to cause the anterior extremities of the posterior pelvic arch to diverge. This tendency to outward deviation is resisted by the anterior pelvic arch, a fact which is well illustrated by observing the way in which the ossa innominata start apart when the ligaments of the pubic symphysis are cut in the operation of symphysiotomy.

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* This wedge-shape is less marked than might at first sight appear. The articular surface of the sacrum is only present on the upper three sacral vertebræ, and is often almost vertical in direction. It is usually more oblique from above downwards and inwards in the female than in the male.

† It is situated slightly to the right of the mesial plane (Struthers, John, *Edin. Med. Journ.*, 1863).

It was formerly supposed that no movement took place at the sacro-iliac joint; but, since the researches of Matthews Duncan,* it has generally been admitted that there is a constant slight motion of the sacrum on a transverse axis, passing through the second segment of the bones, brought about by the force of the body-weight, and causing the position of the sacrum to alter with variations of the position of the body. Thus, when the body is bent forwards, the base of the sacrum is projected downwards and forwards to a slight extent, the antero-posterior diameter of the brim is diminished, and the obliquity of the pelvis is somewhat lessened. At the same time, the apex of the sacrum moves upwards and backwards, but performs a greater excursion than the base, owing to the axis of motion being situated nearer to the latter. A reverse series of movements take place when the body again assumes a vertical position. To quote Matthews Duncan,† 'The movements which occur may be described as consisting in the elevation and depression of the symphysis pubis, the ilia moving upon the sacrum; or if the sacrum be regarded as the moving bone, it describes a nutatory motion upon an imaginary transverse line, passing through the second bone.'

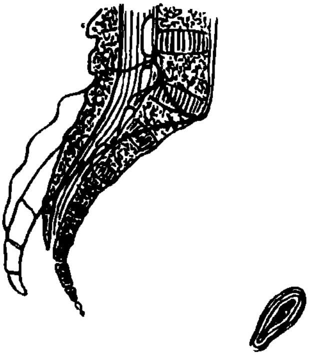

FIG. 19.—DIAGRAM SHOWING NUTATION OF SACRUM DURING PARTURITION. The red outline represents the position of the sacrum when the head is approaching the pelvic outlet. (After Matthews Duncan.)

The sacro-sciatic ligaments exert a powerful influence in limiting the above-described movements by binding the lower part of the sacrum in position. The changes, which they and the other ligamentous structures of the pelvis undergo during pregnancy permit, however, a greatly increased range of motion.

DIFFERENCES BETWEEN MALE AND FEMALE PELVIS.—If typical specimens of male and female pelves are compared, several important points of distinction will be noticed, some of which are due 1 to the difference in muscular development and habits of the sexes, 2 while others are obviously sexual in character and depend upon the peculiar function which the female pelvis has to perform.

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* 'Contributions to Mechanism of Natural and Morbid Parturition,' by J. Mathews Duncan, 1875, pp. 152, 153.

† *Loc. cit.*

1 The female pelvis is altogether built on a more slender scale than the male, the individual bones are lighter, and the impressions for the attachment of muscles are less marked. 2 The depth of the cavity is less, while its breadth and capacity are much greater. 3 The inlet is more regular, and, owing to the comparatively slight forward projection of the sacral promontory, it is more oval than heart-shaped in contour, and its antero-posterior diameter is increased. Looked at as a whole, the pelvis is seen to present fewer angles in the female, to have a more hollowed-out appearance, and to present much less lateral compression. The circumference of the brim measures in the female about 17 inches, and in the male only 15½ inches.

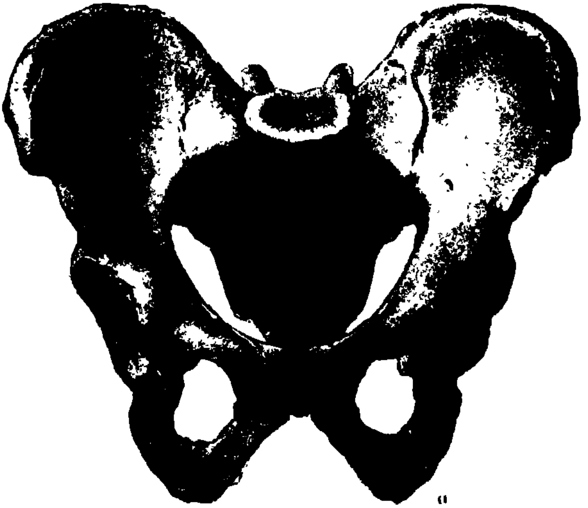

FIG. 20.—MALE PELVIS.
(Slightly less than one-third natural size.)

4 The female sacrum is broader and slightly shorter than the male, and, instead of presenting a uniform curve throughout its entire length, is almost flat in its upper two-thirds, while its lower third is distinctly bent forwards and downwards. Its transverse curvature is also less, and, as a result of the diminished forward projection of its promontory, the pelvis as a whole is less oblique.

A most striking difference, and one which enables as a rule the male and female pelves to be at once distinguished, is the width of the sub-pubic angle and the depth of the symphysis pubis. In the female, the rami of the pubis meet at an angle of from 90° to 100°, and, owing to the presence of the sub-pubic ligament, the angle is rounded off into a gentle curve. In the male, the angle is always acute, and varies from 70° to 75°. 6 The depth of the symphysis is much less in the female than in the male, and the breadth of the pubic bone is greater. This diminished depth, together with the greater divergence of the pubic rami, accounts for the shallowness of the anterior part of the female pelvis; while the great breadth of the body of the pubis gives the obturator foramen a triangular form. The horizontal ramus of the pubis is longer, more slender, and passes more directly outwards; the tubera ischii are more widely separated and the ischial spines are less prominent; 7 furthermore, the sciatic notches are much more extensive, being both wider and shallower in the female. Thomson[*] has shown that the distance from the posterior inferior iliac spine to the anterior margin of the great sciatic notch is greater in the female than in the male, and that therefore the characteristic form of the female notch is due to the greater length of the posterior portion of the ilium. This increased length of the ilium he regards as a marked sexual characteristic, and states that it is present even in the fœtal pelvis.

Turning to the false pelvis, it is seen that the iliac crests are less curved in the female and that the iliac fossæ are more broad and expanded, thus giving rise to the characteristic prominence of the hips, a prominence which is accentuated by the fact that the large transverse diameter causes the acetabula to be set widely apart. The femora, in consequence of being so widely separated at their superior articulation, incline inwards to the knee to a greater extent than in the male, and so give rise to the characteristic side-to-side gait of women. 11 On the whole, the female pelvis forms a shorter and wider canal than the male, and is thus suited to contain the reproductive organs, and to give passage to the fœtus.

The following comparative measurements are taken from Quain[†] (slightly modified):—

DIAMETER.	MALE.			FEMALE.		
	Brim.	Cavity.	Outlet.	Brim.	Cavity.	Outlet.
Antero-posterior	4 in.	4¼ in.	3¼ in.	4¼ in	5 in.	3⅛ in.
Transverse	5 in.	4¾ in.	3½ in.	5¼ in.	5 in.	4⅞ in.
Oblique	4¾ in.	4½ in.	4 in.	5 in.	5¼ in.	4¾ in.

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[*] 'Sexual Differences of the Fœtal Pelvis' (Arthur Thomson, *Journal of Physiology*, vol. xxxiii., p. 359).

[†] Quain's 'Anatomy,' tenth edition, vol. ii., part i., p. 118

Development of the Pelvis.—The form and relative proportions of the pelvis in the infant differ widely from what is found in the adult, but even at birth the more prominent sexual characteristics are present. At birth, the inclination of the pelvic brim is, when the limbs are extended, greater than in the adult; the sacral promontory is placed at a higher level, but does not project so much into the cavity; the iliac fossæ are rather flat, and directed more forwards than inwards, and the iliac crests are only slightly curved. The sacrum is less curved vertically, and was formerly believed to be disproportionately narrow, on account of the small degree of development of its alæ. Thomson has, however, shown that it is really wider in proportion than in the adult, though its maximum width lies above the level of the inlet of the pelvis. The pubic angle is acute, and the width of the pubic bones is proportionately less. The lateral walls are almost parallel, but tend to slope inwards inferiorly and bring the tubera ischii and ischial spines nearer to one another. Even at birth, however, the characteristic preponderance of the transverse over the conjugate diameter is present. The height of the fœtal pelvis in proportion to its width is much greater than in the adult.

During the period of growth, the form of the pelvis is modified by two main factors, the first of which consists in the disproportionate growth of some parts of the pelvis as compared with others, and the second the mechanical effect of the body-weight. The action of the muscles, which are attached to the pelvis also takes some part in producing alterations in form. All of these factors are enabled to bring about considerable alterations in shape owing to the ductile character of the bones, and to the manner in which each of them is developed in several parts. In the sacrum, the alæ grow more rapidly than the central part, and thus enable the transverse diameter to maintain its relation to the conjugate, although this latter is becoming rapidly increased in length by the antero-posterior growth of the ilium. The pubic bones during growth also increase rapidly in a transverse direction.

The manner in which the body-weight is transmitted to the lower limbs has been already described, and the few remarks which will now be added will enable the reader to appreciate how the weight operates in producing some of the varieties of deformed pelvis that occur when the position of centre of gravity of the body is altered by spinal curvature, or when the bones are rendered abnormally soft by rachitic changes.

During growth, the action of the body-weight upon the sacrum is twofold, producing changes in its shape and position. That component of it, which acts along the plane of the pelvic brim, forces the sacrum to sink downwards and forwards between the ilia, and therefore causes the promontory to gradually assume its normal adult level. In producing this effect, the component of the body-weight which acts along the long axis of the sacrum also exerts some influence, and, at the same time, the pull of the posterior sacro-iliac ligaments causes the ilia to become more approximated posteriorly behind the sacrum. Should the sacrum be abnormally yielding, the forward strain exerted upon it will cause its transverse concavity to disappear and to be replaced by a convexity, owing to the central part moving forwards anterior to the lateral portions, which remain fixed by their ligamentous attachments.

The body-weight, as a whole, acting downwards through a point situated nearer to the anterior than the posterior margin of the base of the sacrum, tends to make that bone rotate on its transverse axis. The lower part of the sacrum is, however, held fixed in position by the tension of the sacro-sciatic ligaments, and, in consequence, the bone, unable to rotate, becomes curved vertically by the pressure. In this manner, the inlet and the outlet of the true pelvis become constricted and the conjugate diameter within the cavity is increased.

When considering the pelvic arches, it was stated that the anterior extremities of the posterior arch tended to start asunder as a result of the pull of the sacro-iliac ligaments, and that this tendency was counteracted by the strong tie-beam formed by the pubic arch in front. During growth, when the bones are soft, this action of the body-weight tends to make the innominate bones become more curved, and as the maximum outwardly directed force is situated in the neighbourhood of the acetabula, we would expect to find the concavity greatest in this position, where, moreover, the bones are most liable to yield in consequence of the cartilaginous union of their various parts. Their tendency to curve in this position is, however, resisted by the inward pressure of the heads of the femora,* and, in consequence, the greatest concavity of the bone brought about by the body weight becomes situated more posteriorly where the ilium is thinnest, just in front of its articular surface. The development of a pronounced cavity here has a further marked effect in increasing the extent of the transverse diameter of the brim.

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* This inward pressure is entirely the result of muscular action.

CHAPTER II

ANATOMY OF GENITAL ORGANS, PELVIC FLOOR, AND MAMMARY GLANDS

External Genitals: Labia Majora, Labia Minora; Clitoris, Hymen; Glands of Bartholin; The Vagina—Internal Genitals: The Uterus, Relations, Position, Structure; The Fallopian Tubes, The Ovaries, Structure Graafian Follicle—The Ureter, The Bladder, The Rectum—The Pelvic Floor; Perinæum; Pelvic Diaphragm; Muscles of Pelvis—The Mammary Glands.

The reproductive organs of the female may be described under two headings:—

I. The external genitals, including the vagina.
II. The internal genitals.

THE EXTERNAL GENITALS

The external genitals comprise the mons veneris, the labia majora, the labia minora or nymphæ, the clitoris, and the hymen, and to these structures the general term of vulva or pudendum is applied. They surround the orifice of the vagina, and are placed for the most part within the anterior or urogenital triangle of the perinæum. With them may be considered the vagina, which is a muscular canal extending from the lower portion of the uterus to the vulva, and bringing the cavity of that organ into communication with the exterior. It is principally of interest to the obstetrician as forming a canal through the pelvic floor, which is capable of enormous expansion, and which permits the passage of the child during parturition. Its lower portion lies below the plane of the pelvic outlet, and, together with the surrounding structures, forms what is called by the French 'the dilatable pelvis.'

The Mons Veneris.—The mons veneris forms the most anterior portion of the vulva, and is situated over the symphysis pubis. It constitutes an eminence formed by a mass of areolar and fatty tissue, and is covered by integument, which is continuous above with that of the hypogastrium. It is, however, marked off from the hypogastric region by a faint transverse depression. After puberty, it becomes covered with an abundant supply of crisp hairs, and has opening upon it the ducts of numerous sudoriparous and sebaceous glands.

The Labia Majora.—The labia majora are two rounded folds of integument supported by fatty and fibrous tissue, together with some involuntary muscular fibres. They form the lateral boundaries of the vulva and are homologous to the scrotum in the male. Anteriorly, they unite to form the lower portion of the mons veneris, and from thence proceed in a slightly curved direction downwards and backwards to a point about an inch in front of the anus, where they become united by a transverse fold of skin known as the posterior commissure. Occasionally, they do not unite posteriorly, but pass backwards to the side of the anus, where they gradually fade away. The outer surface of each labium is convex and is covered with skin provided with numerous hairs

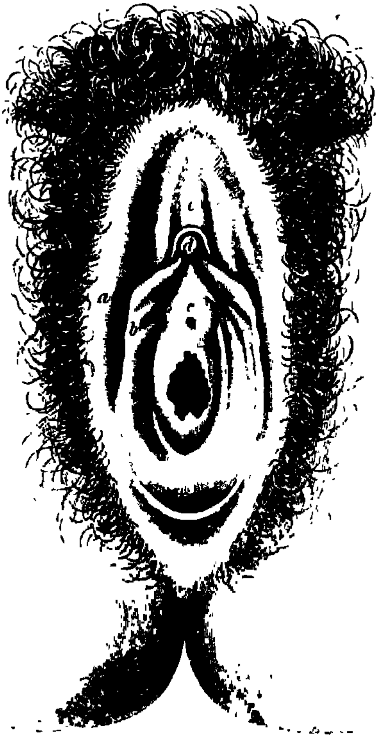

FIG 21.—THE VULVA.

a, Labia majora, b, labia minora; c, meatus urinarius, d, glans clitoridis, e, clitoris; f, mons veneris (Sharpey) and sebaceous glands. The inner surfaces in nulliparæ are in contact with one another, and are covered with soft, smooth integument of a pinkish colour, which is usually moistened by the secretion of large sebaceous glands. Within the substance of each fold, are some non-striated muscular fibres, homologous to the dartos muscle in the male, together with fat, bloodvessels, and nerves. The close apposition of these folds in the virgin usually conceals the remaining structures of the vulva, a median cleft only being visible (urogenital cleft), but in multiparæ and in the aged, owing to the wasting of the adipose tissue which supports them, they frequently become separated and expose to view the labia minora. Hypertrophy of the last named may also cause separation of the labia majora. Under these circumstances, the inner aspects of the labia lose their mucous membrane-like appearance, and the integument covering them becomes thickened and hardened.

3 **The Labia Minora.**—The labia minora, or nymphæ, are two pendulous folds of skin placed on the inner aspect of the labia majora. Posteriorly, they usually end by blending with the inner surface of the corresponding labium majus, but in some cases they become continuous on each side with the fourchette,* a slightly crescentic fold of skin, which lies immediately within the posterior commissure. Anteriorly, they are somewhat elongated, and converge towards the clitoris, at the side of which each divides into two parts. The posterior or inferior part blends on each side with the under surface of the glans clitoridis, forming the so-called fræpulum clitoridis, while the anterior or superior part passes in front of the glans, and becoming continuous with the corresponding fold of the opposite side, forms a sort of hood over the glans called the præputium clitoridis. The outer surface of each nympha is in contact with the labium majus, and the inner surfaces are closely applied to one another. In young subjects these folds are of a delicate pink colour, but in the aged they become pigmented and roughened owing to exposure to the air and contact with the clothes. [illegible] 25 [illegible]

4 **The Clitoris and Vestibule.**—With the clitoris may be described the vestibule, and the principal erectile structures which comprise, besides the clitoris itself, the two crura clitoridis and the bulb of the vestibule.

The clitoris, the homologue of the penis, forms a small projection placed just behind the anterior commissure. Above and below, it is covered by a fold of skin derived from the nymphæ. In structure, it closely resembles, though on a much smaller scale, the male organ, with the exception that it is not perforated by the urethra. It is composed of two corpora cavernosa, which unite to form the body of the organ, and which diverge posteriorly to form the crura clitoridis. These latter are attached on each side to the rami of the ischium and pubis, and are covered by the fibres of the erector clitoridis muscle. The extremity of the organ is formed by a small rounded glans, which caps the anterior extremity of the corpora cavernosa. The glans is formed of erectile tissue and is continuous along the under surface of the clitoris with a small venous plexus, the pars intermedia of Kobelt, which joins the bulb posteriorly. The bulb of the vestibule itself constitutes two oval masses of erectile tissue, which lie one on each side of the orifice of the vagina superficial to the triangular ligament, and which become structurally continuous with one other, in front of the urethral orifice, through the pars intermedia. The inner aspect of each mass is covered by the mucous membrane of the lower portion of the vagina, and over its outer aspect are spread the fibres of the bulbo-cavernosus (superficial sphincter vaginæ) muscle. In addition to these specialised portions of erectile tissue, the whole of the labium majus is abundantly supplied with blood-vessels, and is probably capable of passing into a condition of semi-erection. Erectile tissue is also found in the walls of the vagina.

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* Waldeyer, 'Das Becken,' p. 552.

The whole of the clitoris is abundantly supplied with nerves, and in the glans many of them terminate in special end organs, known as genital corpuscles.

When the labia majora are forcibly separated from one another, a triangular space is exposed, bounded in front by the clitoris, behind by the orifice of the vagina, and on each side by the nymphæ. To this space the term vestibule is applied, and within it is seen the orifice of the urethra situated about an inch posterior to the clitoris and slightly in front of the anterior margin of the vaginal orifice.

The urethral orifice, or meatus urinarius, presents a central depression surrounded by an elevated ridge covered with mucous membrane. This ridge has a somewhat puckered appearance owing to the tonic contraction of the muscular fibres which lie immediately subjacent and which form a superficial sphincter muscle. The meatus lies in the middle line, and just in front of it on each side is placed the orifice of a small tubular gland which lies imbedded in the muscular wall of the urethra. These glands were first described by Skene,* and are usually called by his name. Possibly they represent the anterior extremity of Gärtner's ducts.

The female urethra is about an inch and a half in length, and extends from the neck of the bladder in a direction downwards and forwards beneath the pubic arch to the urinary meatus. It bears the same relation to the pelvic fascia and to the triangular ligament as in the male, and is surrounded, except on its posterior aspect, where it lies imbedded in the vaginal wall, by the fibres of the compressor urethræ muscle. The mucous membrane lining it is continuous with that of the bladder, and, except during micturition, is raised into longitudinally running folds by the tonic contraction of the muscles which surround the canal.

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* Skene, *American Journal of Obstetrics*, April, 1880.

The Hymen.—The hymen forms the anatomical and functional entrance to the vagina.* It is a crescentic fold of integument and mucous membrane attached by its convex margin to the posterior and lateral parts of the vulvo-vaginal entrance. Its concave margin is free and directed forwards, forming the boundary of the introitus vaginæ. Its superficial or inferior surface is continuous with the integument of the vulva, and is separated posteriorly from the fourchette by a small depression, the fossa navicularis. Its superior or deep surface is formed by an extension forwards of the mucous membrane of the posterior vaginal wall, and some of the vaginal rugæ can be traced forwards on to it. Between its two layers are contained some muscular fibres, together with a few small bloodvessels and nerves.

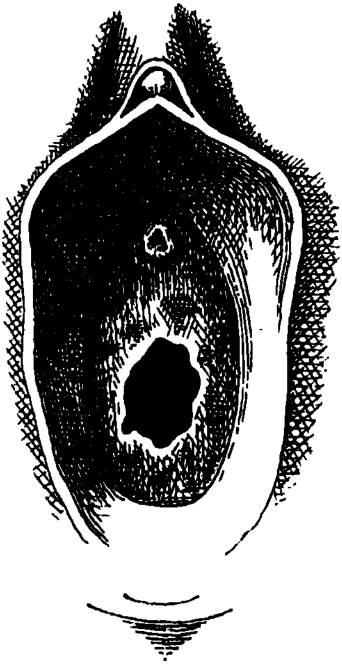

FIG. 22.—DIAGRAM OF NORMAL HYMEN IN A VIRGIN.

The vaginal orifice, thus bounded by the hymen, is usually oval in shape, with its long axis directed from before backwards, and will only admit the tip of the little finger. It is, however, variable in size and shape, depending on variations in form of the hymen. Thus the hymen may be absent, or it may form a complete septum occluding the lower portion of the vagina (hymen imperforatus). It may form a complete ring with a small central or eccentric opening; it may be cribriform or present two orifices separated from one another by a central band; its free margin may present a number of papillæ, or very frequently a series of slight indentations. From a medico-legal and diagnostic point of view, it is important to remember that such indentations do not extend throughout the whole depth of the membrane, being merely notches in the concave margin, and that, furthermore, the edges of such notches are even, and are lined by smooth and continuous mucous membrane.

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* Berry Hart, 'Atlas of Female Pelvic Anatomy,' p. 7.

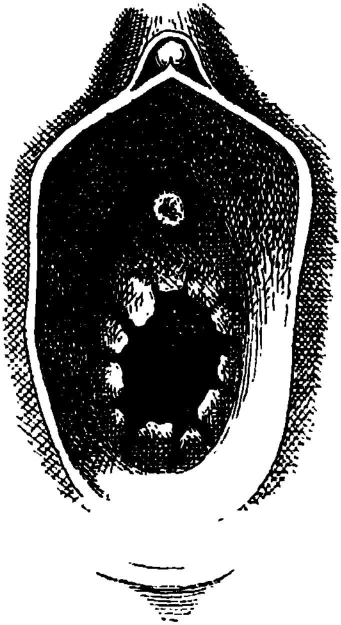

FIG. 23.—DIAGRAM OF HYMEN AFTER COITUS.

The hymen is usually ruptured by the first coitus, and hence has arisen the custom in many countries of regarding it when intact as a sign of virginity. This sign, although useful in conjunction with other evidence, is, however, by no means infallible, for the membrane may be ruptured by a sudden muscular strain, for example, stretching the limbs,* or by a vaginal examination; and, on the other hand, it is sometimes so elastic and distensile that, instead of rupturing during coitus, it folds inwards and comes in contact with the vaginal wall. It has even been known to remain unbroken after the birth of a seven months' child. Ruptures from coitus or from violence usually extend through the whole depth of the membrane and present ragged and uneven margins.

In women who have borne children the hymen is, as a rule,

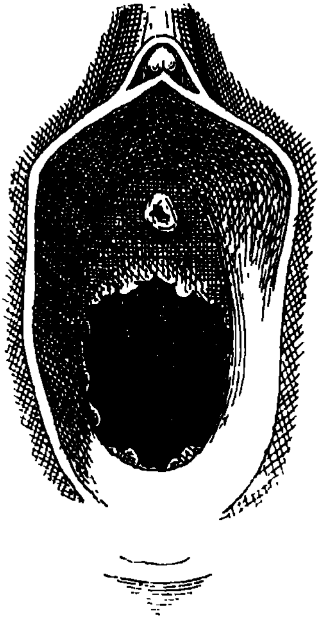

FIG. 24.—DIAGRAM OF HYMEN AFTER DELIVERY, SHOWING CARUNCULÆ MYRTIFORMES.

absent, its place being taken by a series of rounded and irregular tubercles called the carunculæ myrtiformes. These fleshy elevations are quite distinct from one another, and are regarded by Schroeder as isolated portions of the hymen, the intervening parts of which have necrosed owing to the pressure to which they were subjected during labour. According to the same authority, they are never found except after parturition. Others, however, maintain that they have no connection with the hymen, but are independent papillary outgrowths. Their anatomical structure and position, however, support the former view.

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* Playfair, 'The Science and Practice of Midwifery,' vol. i., p. 27.

Glands of Bartholin.—On each side of the orifice of the vagina, in the groove between the attached border of the hymen and the posterior extremity of the labium minus, is situated the orifice of a small duct. These ducts are about half an inch in length, and are derived from glands known, after their discoverer, as Bartholin's glands. The latter are homologous to Cowper's glands in the male, and lie in the same anatomical plane. They are larger, however, each gland attaining the size of a small hazel-nut. Both glands are of a reddish-yellow colour, and secrete a yellowish fluid, which helps to lubricate the vulva during coitus and parturition.

The Vagina.—The vagina is a musculo-aponeurotic canal, which is closed above by its attachment to the cervix uteri, and which passes from thence downwards and forwards, to open on the vulva by means of the *orificium vaginæ*. It is much wider above than below, and thus, when distended, presents a somewhat cone-shaped appearance. Its long axis normally lies parallel to the plane of the pelvic brim, and forms an angle of about 60° with the horizon; but this direction is liable to some variation consequent on the distension of the neighbouring viscera. Thus, as the rectum becomes filled, it pushes the upper part of the vagina forwards, and so makes its axis more vertical; while, on the other hand, distension of the bladder makes the axis more horizontal. The lower portion of the canal passes almost directly forwards over the hymen to its opening below the vestibule. The vagina is normally closed by the apposition of its anterior and posterior walls, and on section presents the appearance of a transverse slit. On each side, however, the slit opens out slightly, so as to form an appearance resembling the letter H. Owing to the fact that the vagina is attached to the uterus at a higher level ~~posteriorly than it is in front, the posterior~~ wall is longer than the anterior, and attains a length of from 3 to 3½ inches, the anterior wall being only about 2½ inches long. In giving these measurements, however, it must be remembered that the vaginal walls are capable of considerable distension in a longitudinal as well as in a transverse direction, and thus, when passing a speculum, this length may seem to be nearly doubled. It has already been pointed out that the vagina is much more capacious above than below, and in consequence each wall is triangular in shape, with its apex situated at the orifice and its base directed upwards.

The posterior wall is covered in its upper part by peritoneum, which is reflected on to it from the rectum, and which forms the bottom of Douglas's pouch. Below this, it lies in relation to the anterior rectal wall, from which, however, it is separated by a loose double layer of connective tissue. The rectal and vaginal walls remain quite distinct, although the name of recto-vaginal septum is often applied to the lower portion of the combined walls. At its orifice, the vagina is separated from the anal canal by the perinæal body. This body is often stated to be peculiar to the female, but it must be regarded as being homologous to the mass of connective and muscular tissue which in the male intervenes between the bulb of the penis and the terminal stage of the rectum, and which contains the central point of the perinæum. In the female the perinæal body is wedge-shaped in form, its base being constituted by that portion of the surface which intervenes between the rectal and vaginal orifice. Its apex is directed upwards, and blends with the so-called recto-vaginal septum. It is composed of dense connective tissue, intermingled with which are some of the fibres of the superficial perinæal muscles, including the sphincter externus of the anus and some fibres of the levator ani, which descend into it from above.

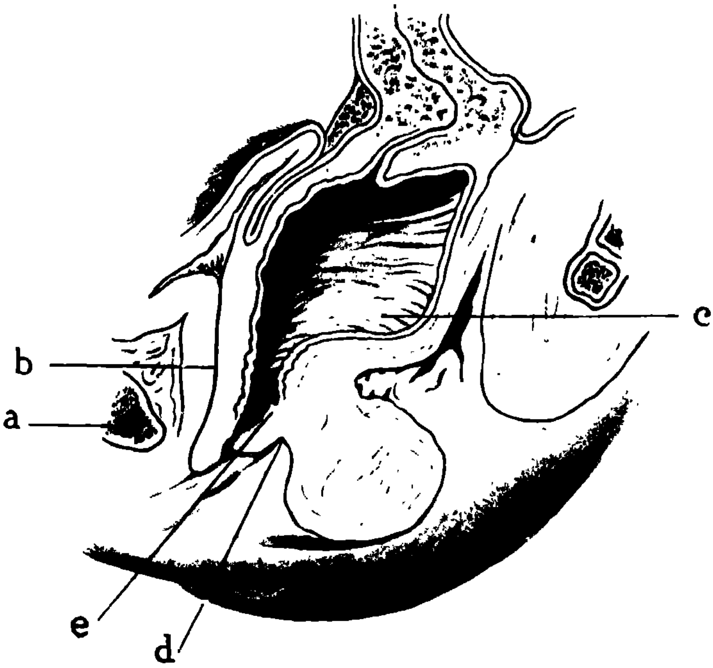

FIG. 25.—SAGITTAL SECTION THROUGH PELVIS, SHOWING VAGINAL RUGÆ.
The vaginal walls are separated artificially. *a*, Symphysis; *b*, urethra; *c*, vagina; *d*, fossa navicularis; *e*, hymen. (Hart.)

The anterior vaginal wall is in relation above to the bladder, and below has the urethra embedded within it. The lateral aspect is supported on both sides by the levator ani muscle, and comes into relation with the ureter just at the point where it joins the uterus.

That portion of the vagina which encircles the cervix uteri is called the fornix, and is divided into an anterior, posterior, and two lateral fornices. The posterior fornix, or recess, is much deeper than the anterior, and is bounded behind by that portion of the posterior vaginal wall which is covered by peritoneum. The uterine artery comes into relation to each lateral fornix, and, especially when enlarged during pregnancy, can be felt pulsating in that position.

The vaginal wall is composed from within outwards of a mucous, muscular, and connective-tissue coat. The mucous membrane is covered by a layer of compound scaly epithelium, into which numerous papillæ project, and which extends on to the lower portion of the cervix uteri. It does not contain any glands. In nulliparæ, both the anterior and posterior walls present numerous transverse folds in the mucous membrane, which are best marked at the lower end of the canal. These folds pass out on each side from one or more mesially placed longitudinal folds, and are obviously adapted to permit of dilatation without injury to the mucous membrane. They are seldom present after parturition. The muscular coat consists of an outer longitudinal and an inner circular layer of smooth muscle fibres. At the lower end of the canal, it is reinforced by fibres of the compressor urethræ and bulbo-cavernosus muscles. The longitudinal layer of fibres is best developed at the upper part of the vagina, and is continuous above with the longitudinal fibres of the uterus. Lying between this muscular and mucous coat is a thin layer of erectile tissue, continuous with the bulb of the vestibule. External to the muscular coat, is found a rather indefinite layer of connective tissue, derived from the pelvic fascia, and in which is embedded a large plexus of veins. The veins are principally massed at the side of the vagina, but also extend on to the anterior and posterior walls. They become enormously dilated in the later months of pregnancy, and it is from them that the serous exudate is derived that infiltrates and softens the tissues prior to parturition. Within the mucous coat, an abundant lymphatic plexus is contained, which is drained, according to Waldeyer,* in three directions. The lower vessels pass, with those of the vulva, to the inguinal glands; the middle pass to the glands of the hypogastrium; and the upper ones, together with those of the uterus, pass outwards in the broad ligament to the external iliac glands.

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* Waldeyer, 'Das Becken,' p. 538.

THE INTERNAL GENITALS

The internal genitals form the true organs of conception, and comprise the Uterus, the Fallopian Tubes, and the Ovaries. The following description, except when otherwise stated, is intended to apply to these viscera as found in the virgin.

The Uterus.—The uterus is a hollow viscus, with stout muscular walls placed within the pelvis, between the bladder and rectum, and connected to both of these structures, as well as to the lateral boundaries of the pelvis, by folds of peritoneum. The fully-developed nulliparous uterus is pear-shaped in form, with the wide end directed upwards, and the narrow end projecting downwards and backwards into the vagina. It is flattened from before backwards, and is divided by a slight ~~constriction called~~ the isthmus into an upper portion or body, ~~and a lower portion~~ or cervix, which are almost of equal length. The term 'fundus' is applied to that portion of the body which lies above the level of the attachment of the Fallopian tubes, and is completely covered by peritoneum. In the virgin, its upper margin is almost flat, and sometimes even presents a slight median concavity, but in women who have borne children it is always strongly convex. From the fundus down to its connection with the cervix, the body of the uterus gradually diminishes in its transverse diameter. The anterior and posterior walls are convex and rounded—more particularly the posterior, and are covered by peritoneum. On

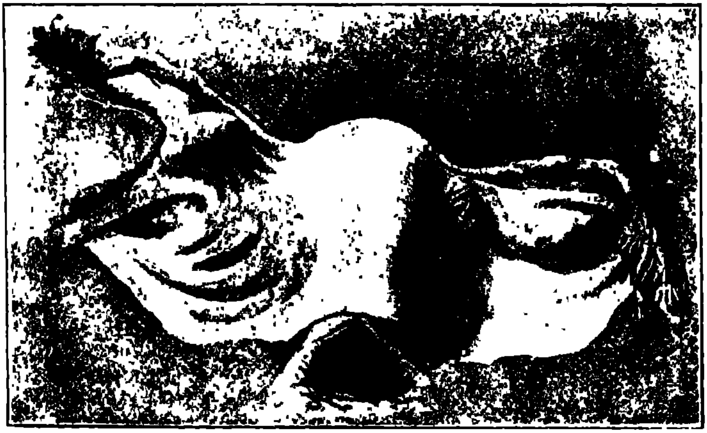

FIG. 26.—VIEW OF THE POSTERIOR SURFACE OF THE UTERUS, FALLOPIAN TUBES, OVARIES, AND BROAD LIGAMENTS.

The infundibulo-pelvic ligament is shown on the left. (Dickinson.)

each side, at the junction of the fundus and the rest of the body, are attached the Fallopian tubes, and a little below and in front of this point are situated the uterine attachments of the round ligaments. The peritoneum, which envelops the uterus, passes out from the latter on both sides as a double fold to the lateral pelvic wall, forming what is called the broad ligament.

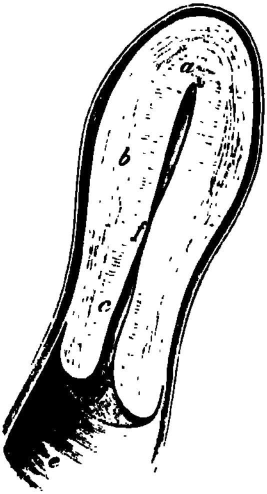

FIG. 27.—VERTICAL SECTION OF UTERUS (DIAGRAMMATIC).
a, Fundus uteri; *b*, corpus uteri; *c*, cervix; *d*, os externum; *e*, vagina; *f*, os internum. (Ramsbottom.)

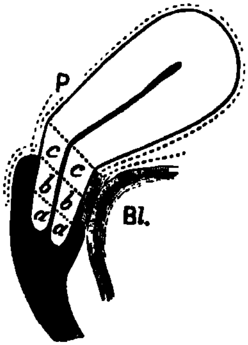

FIG. 28.—DIAGRAM TO SHOW DIVISIONS OF CERVIX.
c, Portio supra-vaginalis; *b*, pars intermedia; *a*, portio infra-vaginalis; P, peritoneum; Bl., bladder. (Schroeder.)

The cervix is the lower cylindrical part of the uterus, and projects inferiorly into the vagina. It is divided into three parts, according to their relations to the vaginal walls—the portio vaginalis, the pars intermedia, and the portio supra-vaginalis. The relations of these parts can be clearly seen by referring to the diagram. The supra-vaginal part is covered posteriorly by peritoneum, but in front is in direct relation to the bladder-wall, the peritoneum being reflected from the uterus on to the bladder, a little below the level of the isthmus. The vaginal portion presents on its inferior aspect a transversely-directed aperture called the *os externum*, by which the cavity of the uterus is brought into communication with the vaginal canal. This aperture is bounded by an anterior and a posterior lip, the latter of which is the longer of the two, on account of the high attachment of the vaginal wall to the uterus posteriorly.

Owing to the great thickness of the uterine wall, the cavity is much smaller than the size of the organ itself. Two main divisions of it can be recognised, corresponding to the body and cervix respectively. In the upper part, the anterior and posterior walls lie in contact with one another, and thus cause the cavity to be flattened antero-posteriorly and to be triangular in shape. The sides and base of the triangle are somewhat curved, with the convexity directed inwards towards the cavity. The base is directed upwards, and on each side of it a small diverticulum is prolonged into the Fallopian tube, and communicates with the canal of the tube by means of a very small aperture. The apex of the cavity is directed downwards, and is marked off from the cavity of the cervix by a constriction, the *os internum*, which is situated at the same level as the isthmus externally.

The cavity of the cervix extends from the os internum to the os externum. It is wider in the middle than at either end, and therefore has a fusiform shape. The mucous membrane lining it presents two well-marked longitudinal ridges situated on the middle line of the anterior and posterior walls respectively. From these ridges a number of folds pass upwards and outwards obliquely on each side, forming an appearance to which the name of arbor vitæ has been applied.

Dimensions.—The dimensions of the uterus itself and of its cavity vary within comparatively wide limits, and are, as a rule, greater in women who have borne children than in nulliparæ. The following measurements are given by Waldeyer,* and may be taken as the average:—

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* Waldeyer, 'Das Becken,' p 496.

Length.	Nulliparæ.	Multiparæ.
Entire uterus	2⅝ in (6·5 cm.)	3 in (7·5 cm.)
Corpus uteri	1⅝ in (4·0 cm.)	1¾ in. (4·5 cm.)
Cervix uteri	1 in (2·5 cm.)	1¼ in. (3·0 cm.)
Entire cavity	2⅛ in. (5·5 cm.)	2⅝ in (6·5 cm.)
Cavity of body	1¼ in. (3·0 cm.)	1⅝ in. (4·0 cm.)
Cavity of cervix	1 in (2·5 cm.)	1 in (2·5 cm.)

The greatest breadth of the body is from 1⅜ to 1⅝ inches (3·5 to 4 cm.) and the greatest thickness from 1 to 1⅕ inches (2·5 to 3 cm.), in nulliparæ. In multiparæ, the breadth may reach 2 inches (5 cm.), and the thickness averages about 1⅕ inches (3 cm).

From the above measurements, it will be seen that the cavity of the uterus is about half an inch shorter than the entire organ in both nulliparæ and parous women, and that the increase in size, which persists after pregnancy, is accounted for by an enlargement of the cavity rather than by an increased thickness of the uterine walls.

It is not until the age of puberty is reached that the uterus attains its full size. Up to that period of life it develops very slowly, and the cervix is of much greater relative size than the body. At puberty, however, rapid growth is established for a time, and especially in the body, so that the full adult form is quickly attained. The uterus of a virgin usually weighs about an ounce, in multiparæ it is slightly heavier.

The Connections of the Uterus.—The uterus may be regarded as being slung in the pelvic cavity by means of the broad ligaments. These ligaments are double folds of peritoneum, which pass from the lateral margins of the uterus to the pelvic wall, and which contain between their layers the Fallopian tube or oviduct, the ovary, the parovarium, the paroophoron, the round ligament, and the uterine and ovarian vessels, nerves, and lymphatics. The upper margin of each ligament is free, and here the two layers become continuous with one another above the oviduct. Below, the ligament is fixed by its connections with the pelvic fascia, and externally the two layers which form it are continuous with the peritoneum which lines the lateral aspect of the pelvic cavity and which passes upwards into the abdomen. These ligaments are somewhat lax, and allow slight movement of the uterus to either side. The other peritoneal ligaments of the uterus are the two anterior or utero-vesical, and the two posterior or utero-sacral; along with these the round ligaments, though of a different nature, may be described.

The anterior ligaments are two slight and unimportant folds of peritoneum, which pass from the cervix uteri to the posterior aspect of the bladder. They form the lateral extremities of the reflection of the peritoneum from the uterus on to the bladder, and bound the utero-vesical pouch on each side.* The utero-sacral ligaments are also folds of peritoneum passing from the posterior aspect of the lower part of the corpus uteri backwards to the sides of the rectum, at about the level of the third sacral vertebra, and bounding the pouch of Douglas, or recto-vaginal pouch, on each side. They are much more strongly developed than the anterior ligaments, and contain between their layers a considerable quantity of unstriped muscular tissue, which by its contraction probably plays an important part in enabling the uterus to adapt its position to changes in the size of adjoining viscera. The round ligaments are attached to the corpus uteri just below and in front of the Fallopian tubes. They are flattened muscular cords, the fibres of which are continuous with the external layer of longitudinal muscle fibres of the uterine wall, and are surrounded by an irregular mass of involuntary muscle fibres. Commencing at the uterus, they pass on each side upwards, outwards, and forwards in a fold of the anterior layer of the broad ligament to the internal abdominal ring, and having traversed the inguinal canal, they terminate in the subcutaneous tissue of the labium majus. They probably exercise some influence in drawing the uterus forwards.

The Position of the Uterus.—Owing to the small size of the pelvis, the uterus in the fœtus, and for some time after birth, lies above the brim of the pelvis, and is in the greater part of its extent an abdominal organ. During growth, it gradually sinks, and about the tenth year of life it reaches its adult position, with the upper margin of the fundus at the level of the pelvic brim. It has been stated that the uterus may be regarded as being slung in the pelvis by the two broad ligaments. Owing to the laxity of these ligaments and the other folds of peritoneum which are attached to it, it is freely movable in an antero-posterior direction around a transverse axis passing through the lower border of the broad ligaments about the level of the isthmus. It is also capable of movement, though to a less extent, in a lateral direction. These movements are normal, and are chiefly determined by the degree of distension of the bladder and rectum. When both these viscera are moderately distended, the long axis of the uterus is usually found to be parallel to the axis of the pelvic brim, and therefore almost at right angles to the axis of the vagina. The fundus is directed upwards and forwards, and the anterior wall lies in contact with the bladder. As the bladder gradually fills, the uterus is driven upwards and backwards, and, turning upon its transverse axis, assumes a vertical position. In cases of extreme distension of the bladder, the uterus may even become retroverted. When the bladder is quite empty, the fundus and body of the uterus lie upon its upper surface, and the corpus uteri makes a distinct angle with the cervix. It is important therefore to bear in mind that the uterus is essentially a mobile organ, the movements being for the most part passive, and depending upon the different external pressures to which it is subjected. It cannot therefore be said to have any one normal position.

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* It would perhaps be more correct to describe only one utero-vesical ligament, and to define it as the peritoneum reflected from the uterus on to the back of the bladder.

The Structure of the Uterus.—The uterine wall is composed of an outer serous, a middle muscular, and an internal mucous coat.

The serous coat, composed of the peritoneal covering of the uterus, has already been sufficiently dealt with. It is bound to the muscular coat by a thin layer of connective tissue—the parametrium, which is continuous with the areolar tissue contained between the layers of the broad ligament. This connective tissue is more abundant at the sides and in front than elsewhere.

The muscular coat is nearly a quarter of an inch thick. It is composed of involuntary muscular tissue, most of the fibres of which are of small size. In the non-gravid uterus, these fibres are so closely interwoven and bound together by connective tissue that it is very difficult to distinguish any layers. During pregnancy, however, the muscle fibres themselves become hypertrophied, and the bands which they form becoming more differentiated, it is usually possible to distinguish three different strata. The most superficial of these strata, according to some authorities,* is the only representative of the muscular coat proper, all the rest forming a greatly hypertrophied muscularis mucosæ. It is composed of longitudinally running bundles, which, commencing at the cervix, arch over the fundus. On each side it sends off some fibres into the broad ligament, the uppermost of which pass to the inferior pole of the ovary and constitute the ovarian ligament. From this layer also are derived the fibres of the round ligament. The middle stratum forms the principal mass of the muscular coat, and is composed of fibres which interlace closely with one another, running both in a transverse and an oblique direction, while the internal stratum is formed of circular fibres. Above, the last named is continuous with the circular fibres of the Fallopian tubes, and below, it becomes aggregated into bundles which form sphincter muscles for both the os internum and the os externum. In the cervix, the muscular tissue is, according to Waldeyer,† much less compact than elsewhere, and there is a layer of longitudinally running fibres internal to the transverse ones.

The mucous membrane of the uterus is directly connected with the innermost layer of the muscular coat without the intervention of a submucous layer. That which lines the body of the uterus is soft and smooth, and in the intervals between the menstrual periods is about a millimetre in thickness. It is composed of connective and elastic tissue, the fibres of which unite to form a meshwork of lymph sinuses. Scattered throughout it, also, are found numerous lymphoid cells. It is covered by a layer of

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* Williams, John, *Trans. Obst. Society*, vol. xxvii.

† Waldeyer, 'Das Becken,' p. 468.

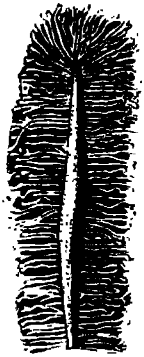

FIG. 29.—SECTION OF THE MUCOUS MEMBRANE OF THE BODY OF THE UTERUS AT THE COMMENCEMENT OF PREGNANCY, SHOWING THE UTERINE GLANDS. (Galabin.)

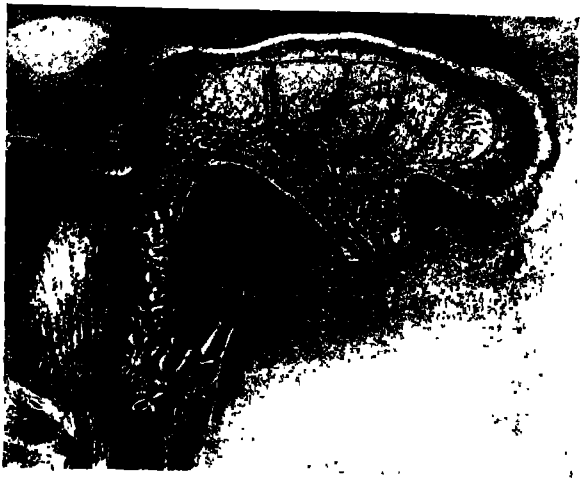

FIG. 30.—BLOOD-SUPPLY OF UTERUS, OVARY, AND FALLOPIAN TUBES (ANTERIOR VIEW).

Ur., ureter; U.A., uterine artery; U.V., uterine vein; O.A., ovarian artery; O.V., ovarian vein. (Kelly.)

columnar ciliated epithelium, and opening on its surface are the orifices of numbers of minute glands which lie embedded in its substance. These glands are, for the most part, simple tubes, lined by a layer of ciliated epithelium continuous with and similar to that which lines the cavity, and supported by a slender basement membrane. They extend throughout the whole depth of the mucous membrane, and sometimes have their bases placed amid the innermost fibres of the muscular coat. Most of them run rather obliquely, but some pass directly outwards.

The mucous membrane of the cervix differs from that of the body in being much firmer and more closely adherent to the subjacent tissue, and a sharp line of demarcation exists between the two. The upper portion of the cervix is lined by ciliated epithelium, and contains within its substance numerous tubular and acinous glands, the ducts of which open upon its surface. The extreme lower portion is lined with squamous epithelium continued in through the os externum, and possesses no glands. The peculiar arrangement, which gives rise to the appearance known as the arbor vitæ, has been already described.

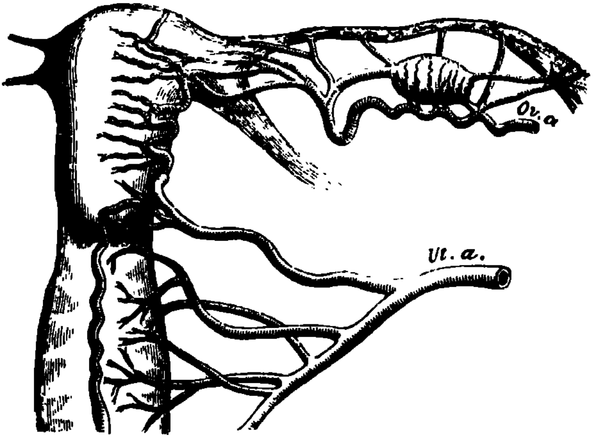

FIG. 31.—DIAGRAM OF BLOOD-SUPPLY OF UTERUS AND ADNEXA

Ov. a., ovarian artery; Ut. a, uterine artery. Note the free anastomosis between the ovarian and uterine arteries in the neighbourhood of the fundus uteri. (Williams.)

The Uterine Bloodvessels and Lymphatics.—The principal arteries of supply to the uterus are the uterine, which come one at each side from the anterior division of the internal iliac vessels, and pass downwards and inwards in the broad ligament to the cervix. Here, they give off a few small twigs to the vagina, and then turn upwards along the lateral border of the uterus and anastomose near the fundus with branches from the ovarian arteries. These last-named vessels form a large part of the blood-supply to the fundus. The course of the uterine arteries by the side of the uterus is very tortuous, and as they pass upwards they give off numerous branches which pursue an almost transverse course on the anterior and posterior uterine wall. These transverse branches are also tortuous, and are placed in a special layer of connective tissue deep to the external longitudinal muscular layer.* From them, twigs are given off which pass vertically inwards and end in the mucous membrane in a capillary plexus draining itself into thin-walled veins devoid of valves. These veins gradually unite into branches corresponding to the arteries, and form what are known in the gravid uterus as the uterine sinuses. The larger branches communicate with a venous plexus lying in the broad ligament, and are ultimately drained by the uterine and ovarian veins.

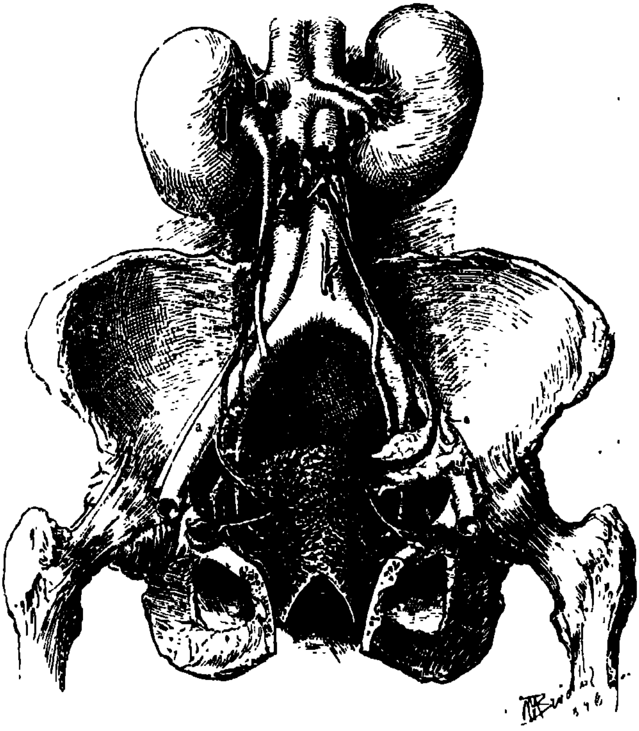

Fig. 32.—Lymphatics of the Pelvic Organs. (Kelly.)

The lymphatics of the uterus are arranged in three distinct plexuses which communicate with one another, one being situated in the mucous coat, to which reference has already been made, one in the muscular coat, and one beneath the serous coat. The vessels arising from them drain their lymph into the lumbar and hypogastric glands.

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* Williams, *loc. cit.*

The Nerves of the Uterus.—According to most authorities there is a centre for uterine movement situated in the lumbar region of the spinal cord. The fibres from this centre emerge by the third, fourth, and fifth, lumbar nerves and possibly from some sacral nerves and

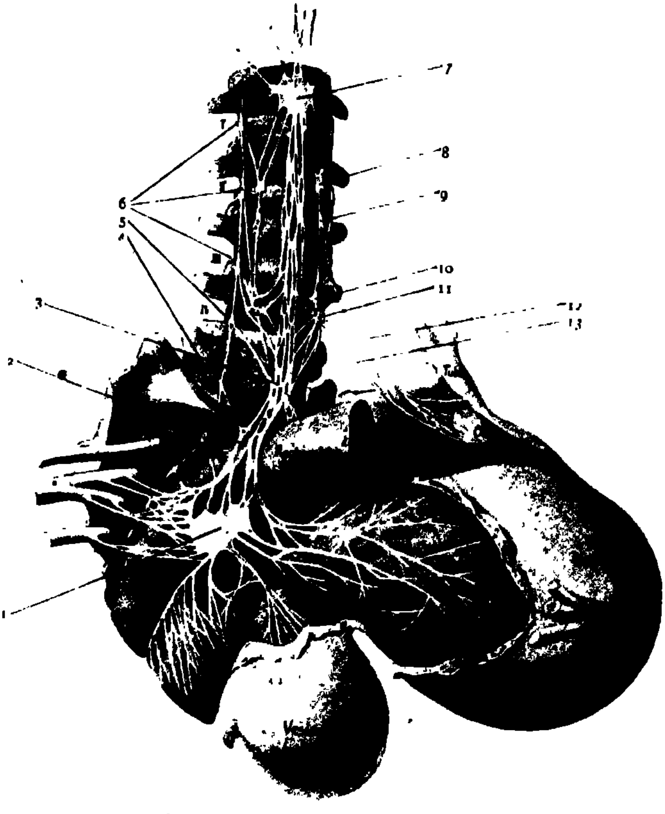

FIG. 33.—NERVES OF THE UTERUS.
1, Right ganglion cervicis; 2, right hypogastric plexus; 3, uterine plexus, 4, 5, 6, lumbar sympathetic, 7, solar ganglion; 8, 9, renal ganglia, 10, 11, genital ganglia; 12, 13, ovarian plexus. I., II., III., IV., lumbar vertebræ. (Bumm.)

communicate with the pelvic plexuses of the sympathetic. Nerves composed of mixed cerebro-spinal and sympathetic fibres then pass between the folds of the utero-sacral and broad ligaments to the uterus, where they communicate with a large ganglion, or rather, series of small ganglia, situated on the posterior aspect and sides of the cervix uteri—the cervical ganglion. From this ganglion, fibres are distributed to the whole uterus, including the cervix, and some of these terminate in muscle cells. It is uncertain whether any branches pass directly to the uterus without first communicating with the cervical ganglion. Many of the nerve fibres are destined for the supply of the bloodvessels, but without doubt some control the uterine contractions, for if the lumbar centre be destroyed all power of parturition is abolished. Stimulation of the nerves, moreover, produces powerful uterine and vaginal contractions.

The Fallopian Tubes.—The Fallopian tubes or oviducts are the muscular canals through which the ovum passes on its way to the uterus. They pass out from the superior angle of the lateral border of the uterus in the upper free border of the broad ligament for a distance of from four to five inches. On first leaving the uterus, they pursue a horizontal course, lying on the pelvic floor, till they reach the lateral pelvic wall, when they turn upwards and pass in a rather tortuous manner along the anterior border of the ovary, till, reaching its superior pole, they terminate by spreading out on its superior and inner aspect. Each tube may be divided into three portions, an interstitial part lying between the layers of the uterine wall, an isthmus, and an ampulla. The intra-uterine or interstitial portion is about half an inch in length, and communicates with the cavity of the uterus by means of a very minute orifice, the ostium internum, which in the healthy state will hardly admit the passage of a bristle. The part immediately succeeding this,

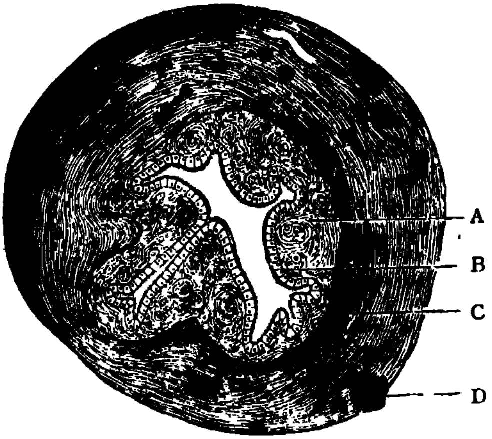

Fig. 34.—Section through Isthmus of Fallopian Tube.
A, Submucous layer; B, ciliated epithelium; C, circular muscle fibres; D, longitudinal muscle fibres. (Macalister.)

and forming ~~about the inner third~~ of ~~the free portion~~ of the tube, is round and cord-like, and has received the name of the isthmus on account of its extremely small lumen, which does not exceed two millimetres in diameter. The outer two-thirds of the tube is much wider, its lumen having a diameter of about six millimetres. It is hence known as the ampulla, and constitutes that portion of the tube which is in relation to the ovary. It terminates in a somewhat bell-shaped manner by expanding to surround its orifice, the ostium abdominale, which opens into the peritoneal cavity. This orifice is kept closed during life, as is, indeed, the whole extent of the ampulla, by the tonic contraction of the muscular walls ot the tube, and is surrounded by a number of fimbriæ, one of which is attached to the superior pole of the ovary, and has received the special name of the ~~ovarian fimbria~~.

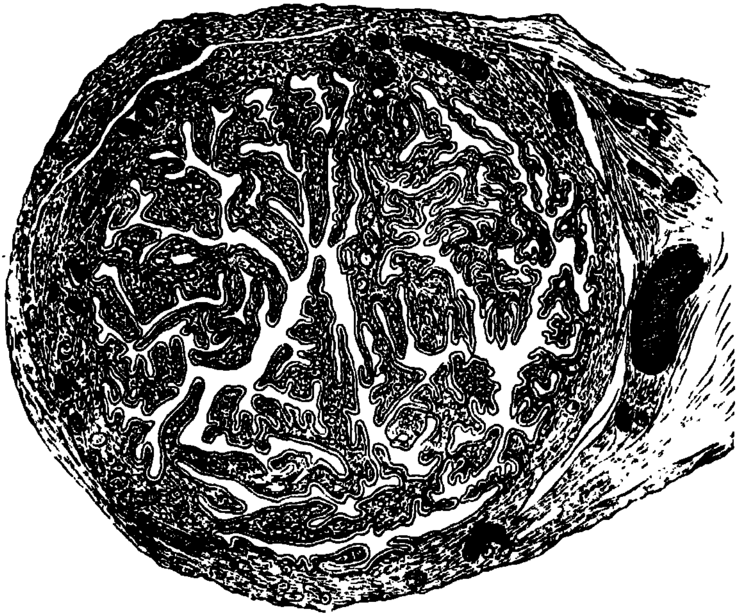

FIG. 35.—TRANSVERSE SECTION OF AMPULLA OF FALLOPIAN TUBE, SHOWING THE COMPLICATED ARRANGEMENT OF THE LONGITUDINAL PLICATIONS WHICH ARE HERE CUT ACROSS. (Ahlfeld.)

In addition to a thin peritoneal covering, the tubes possess a muscular and a mucous coat. The muscular coat is composed of an outer layer of longitudinal and an inner layer of circular fibres, which are continuous respectively with the outer and inner layers of the muscular wall of the uterus. The mucous membrane and the fimbriæ are covered by a layer of ciliated epithelium, the ciliæ of which produce a current in the direction of the uterus, and which was supposed to exercise an important function in propelling the ovum into the uterine cavity. In transverse sections through the tube it is seen that the mucous membrane is thrown into a series of longitudinal folds by the contraction of its walls. These folds are best marked in the outer part of the tube, and they entirely disappear when the canal is distended with injection.

The blood-supply of the tubes is derived from the uterine and ovarian vessels.

3 **The Ovaries.** — The ovaries are two small, somewhat oval, bodies, situated one on each side of the pelvic cavity, in a special fold of the posterior layer of the broad ligament. In size, they have been compared to almonds, and they weigh in the adult from 6 to 8 grammes. They measure from 3 to 5 centimetres in length, from 1½ to 3 centimetres in breadth, and from a half to 1½ centimetres in thickness (Waldeyer*). In the full-term fœtus they are much larger in proportion to the size of the body than in the adult, and are situated almost completely above the pelvic brim in the iliac fossæ. They gradually descend during growth, and in the adult virgin are found lying in relation to the posterior part of the lateral pelvic wall, immediately anterior to the internal iliac arteries and external to the utero-sacral ligament. Most recent observers state that their long ~~axis is directed vertically~~. They are ~~flattened from side to side~~, and present for examination an anterior and a posterior border, an outer and an inner surface, and an upper and lower pole.

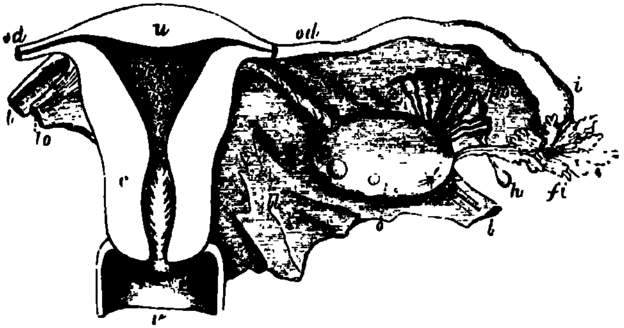

FIG. 36.—DIAGRAM OF UTERUS AND APPENDAGES.

od, Fallopian tube; *i*, ampulla of tube; *fi*, fimbriated end of tube; *o*, ovary, *po*, parovarium; *v*, vagina; *u* and *c* are placed on the upper and lateral uterine walls respectively; *l*, round ligament; *lo*, uterine ligament of ovary. (Quain.)

The anterior border is known as the hilus. It receives the ovarian vessels and nerves, and is fixed by these to the broad ligament. The posterior border, together with the outer and inner surface, is free, and is covered by a layer of columnar epithelium, which must be regarded as modified peritoneum. The relation of the Fallopian tube to the two borders and to the inner surface has already been described. The outer surface is in relation to the peritoneum lining the lateral pelvic wall. The superior pole is known as the tubal pole, owing to its attachment to the ovarian fimbria. Passing from it to the lateral pelvic wall, there is a special fold of peritoneum—the ovario-pelvic ligament. The inferior, or uterine, pole is directed downwards, and is connected to the lateral border of the uterus by means of a muscular band, derived from the longitudinal muscle fibres of the uterine wall, and called the ovarian ligament.

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* Waldeyer, 'Das Becken,' p. 521.

The ovary, as well as the uterus, must be regarded as an essentially movable organ, its position depending largely upon that of the uterus. It is greatly displaced during pregnancy, and never regains its original position.

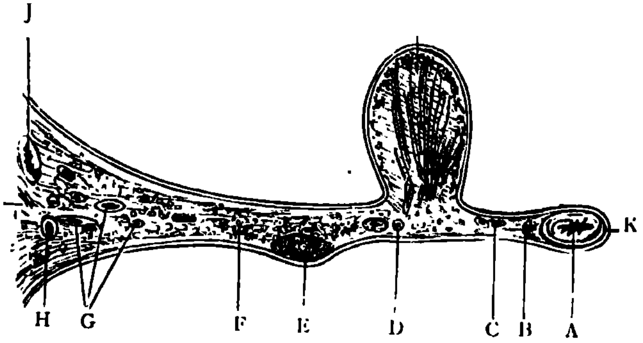

FIG. 37.—VERTICAL SECTION THROUGH BROAD LIGAMENT.

A, Fallopian tube; B, tubal branch of ovarian vessels; C, parovarium, D, ovarian artery; E, round ligament; F, connective tissue; G, uterine veins; H, uterine artery; I, ovary; J, ureter; K, peritoneum. (Anderson.)

Structure of the Ovary.—In order that the structure of the ovary may be understood, it is necessary to refer briefly to the method of its development.

When transverse sections are made through the embryo of a chick at about the second day an accumulation of mesoblastic tissue is found lying on each side of the mesial plane, between the lateral plates and paraxial portions of the mesoblast. This is called the intermediate cell mass, and it is within it that the ovary and primitive kidney is formed. The inner portion of this mesoblast is early raised up into a definite ridge—the genital ridge, and is covered by a thick layer of hypoblast—the germinal epithelium. Some of the cells of this epithelium are larger than others, and are known as the primordial ova. Very soon, outgrowths of this epithelial layer begin to extend into the subjacent mesoblast, and become arranged in such a manner that the primordial ova are surrounded by a layer of the undifferentiated cells. These downgrowths soon become separated from the surface, and form the primitive Graafian follicles embedded in mesoblast, from which the stroma of the ovary is formed. The rudiment of the ovary lies at first within the abdomen on the psoas muscle, immediately below the kidney, but it is gradually moved downwards, and finally takes up its position within the pelvis.

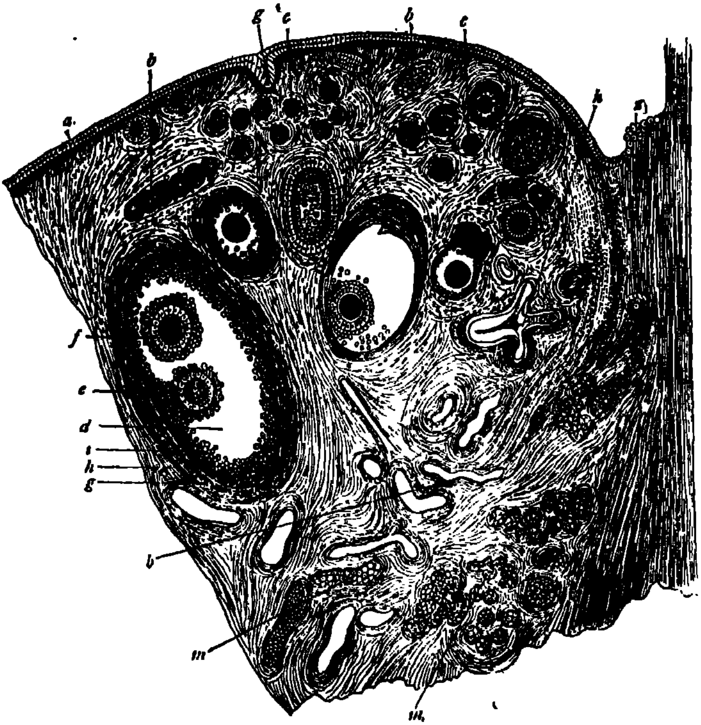

FIG. 38.—SECTION THROUGH PART OF OVARY OF ADULT BITCH

a, Germinal epithelium; *b*, *b*, ingrowths (egg-tubes) from the germinal epithelium, seen in cross-section; *c*, *c*, young Graafian follicles in the cortical layer; *d*, a more mature follicle, containing two ova (this is rare), *e* and *f*, ova surrounded by cells of discus proligerus; *g*, *h*, outer and inner capsules of the follicle; *i*, membrana granulosa; *l*, bloodvessels. *m*, *m*, parovarium; *g*, germinal epithelium commencing to grow in and form an egg-tube; *z*, transition from peritoneal to germinal epithelium. (Waldeyer.)

When sections are made through the mature ovary, appearances are seen which correspond with the method of development. It is composed of an inner medullary and an outer cortical portion, and is covered by a layer of columnar epithelium continuous with the peritoneum. The medulla is composed of rather loosely-arranged bundles of fibrous and elastic tissue, and contains the large bloodvessels and nerves which have passed into it from the hilus. There is no sharp line of demarcation between the cortex and the medulla, as the latter sends out processes of connective tissue, which extend in a radial manner into the cortex, conveying the bloodvessels and nerves, and blending with the stroma of that portion of the organ. The cortex is composed of two portions—the stroma, which is chiefly mesoblastic in origin, and the ova, lying in the Graafian follicles. The stroma constitutes the great bulk of the organ, and is largely composed of spindle-shaped connective-tissue cells, arranged in bundles so as to form a supporting network for the follicles. In addition to these cells, however, it also contains a number of polyhedral cells, supposed to be epithelial in nature, and which are sometimes credited with the formation of a hypothetical internal secretion. Immediately beneath the epithelium which covers the ovary the stroma contains no ova, and forms a condensed fibrous layer called the tunica albuginea. In the superficial layers of the cortex, immediately under the tunica albuginea, only immature ova are found, surrounded by a single layer of cells, which alone separates them from the stroma ; but a little deeper the ova themselves are found to be of larger size, and the cells surrounding them are increased in number, so as to form an envelope composed of

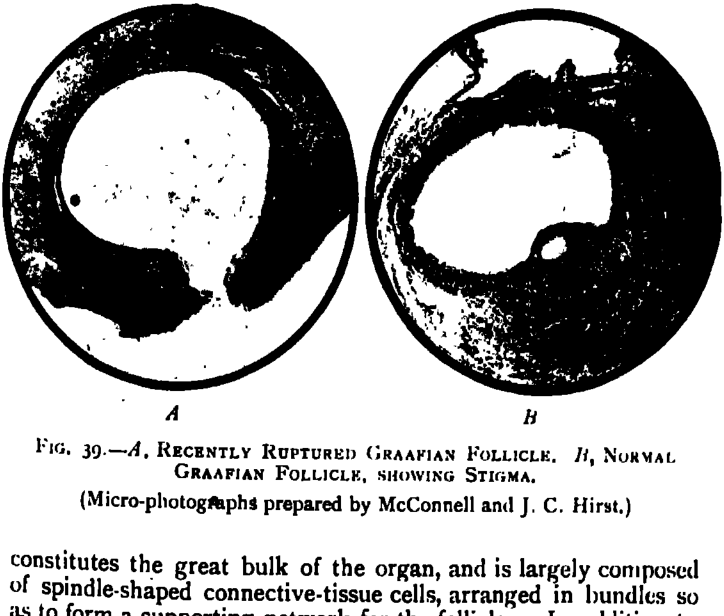

FIG. 39.—*A*, RECENTLY RUPTURED GRAAFIAN FOLLICLE. *B*, NORMAL GRAAFIAN FOLLICLE, SHOWING STIGMA.

(Micro-photographs prepared by McConnell and J. C. Hirst.)

several layers of cells, the outer and inner layers of which have taken on a columnar character. Lying outside the external layer of columnar cells is a definite fibrous membrane, which separates the entire structure from the general stroma, and which contains capillary bloodvessels in its inner portion. The complete structure contained within this limiting membrane is called a Graafian follicle.

As growth proceeds, the cells surrounding the ovum still further increase in number, and, with the exception of the outer and inner layer, become polygonal in shape, as a result of mutual pressure. Still later, fluid is effused into the midst of the cells separating them into an outer and an inner layer, called respectively the membrana granulosa and the discus proligerus. The two layers always, however, remain continuous with one another at one part of the follicle. The fluid which separates the cells is called the liquor folliculi. The Graafian follicle now presents the following structures from without inwards:—

1. The basement membrane or theca, composed of an outer fibrous and an inner vascular layer.
2. A boundary layer of columnar cells.
3. The membrana granulosa.
4. The liquor folliculi.
5. The discus proligerus.
6. The ovum.

An account of the ovum will be given in the next chapter, which deals with its development.

While the above-described changes are going on within it, the Graafian follicle is gradually, owing to its distension, approaching the surface of the ovary, and on reaching this it bursts; the ovum is expelled into the peritoneal cavity, and the liquor folliculi escapes. The rupture of follicles in this manner accounts for the scars which are found on the serous covering of the ovary after puberty.

Corpus Luteum.—The rupture of the Graafian follicle probably coincides with the date of the menstrual flow, and is doubtless aided by the general congestion of the reproductive organs which occurs at that time. After rupture, the walls of the empty follicle contract and come in contact with one another. The inner layer of the theca is less contractile than the outer, and is therefore thrown into a series of folds. Proliferation of the cells of the membrana granulosa then occurs, and gradually fills up the interior of the follicle and the cavity left on the surface of the ovary by its rupture. A small amount of the space left by the rupture is also filled up by some blood-clot which has been extravasated at that time. During the same period, small tufts of bloodvessels accompanied by fibrous tissue grow in towards the centre of the follicle from the inner layer of the limiting membrane. The entire structure, composed of blood-clot, proliferated epithelial cells, vascular loops, and fibrous tissue, is known as the corpus luteum, this name being given on account of the presence of a yellowish pigment within the cells. Growth goes on for a period of about three weeks within the corpus luteum, but after this time the cells cease to proliferate, and begin to break down into a yellowish detritus, while at the same time the fibrous tissue encroaches more and more on the cellular part and reaches the centre of the structure. Absorption of the broken-down matter now commences, and after a period of two months from the date of rupture nothing is left of the corpus luteum but a fibrous scar.

The above is the normal course of events in cases in which conception has not occurred, but when pregnancy supervenes upon the discharge of the ovum the corpus luteum attains a larger size. It continues to grow till the third or fourth month; its walls are thicker and its colour a much brighter yellow. Absorption also occurs slowly, so that at the end of pregnancy it may still have a diameter of from 8 to 10 millimetres. The corpus luteum of pregnancy is sometimes called the true corpus luteum, in contradistinction to that of menstruation, which is called the false corpus luteum. The increased size, which the former attains, may be associated with the greatly increased blood-supply to the pelvic organs during pregnancy.

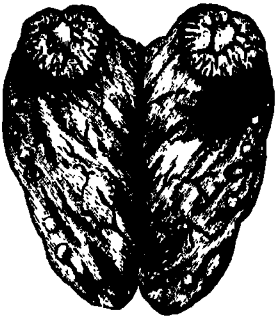

FIG. 40.—THE CORPUS LUTEUM AT THE END OF PREGNANCY (Dalton.)

THE REMAINING PELVIC ORGANS

A very brief description of the intra-pelvic portion of the ureter, of the bladder, and of the rectum will now be given in order that the relation of these viscera to the pelvic floor and to the genital organs may be understood.

The Ureters.—The ureter enters the pelvis by crossing the common iliac artery close to its bifurcation, and turns downwards and inwards in front of the internal iliac vessels. Reaching the inner side of this artery about the level of the upper margin of the fourth sacral vertebra, it turns forwards in relation to the outer pelvic wall, from which, however, it is separated by a quantity of loose connective tissue. On its way forwards, it passes under cover of the lower border of the broad ligament, at which place it is crossed by the uterine artery and vein, and comes into relation with the lateral fornix of the vagina at the point where the vaginal wall blends with the cervix uteri. Finally, it turns forwards, inwards, and downwards around the lateral vaginal wall to enter the posterior aspect of the bladder.

2 **The Bladder.**—The bladder in the semi-distended state is tetrahedral in form, with its long axis directed antero-posteriorly. The apex lies in relation to the anterior abdominal wall just above the symphysis pubis. The base is directed backwards and is almost vertical in direction. Above, the base is separated from the uterus by the utero-vesical pouch of peritoneum, while, below, it is in direct relation to the anterior uterine wall and to the anterior wall of the vagina, forming with the latter the vesico-vaginal septum. The superior surface of the bladder forms a horizontal shelf in the pelvis, upon which the fundus uteri and some coils of small intestine are supported. Inferiorly, the bladder lies in contact with the symphysis pubis and retropubic pad of fat near the mesial plane, and laterally is supported by the anterior fibres of the levator ani muscle (pubo-coccygeus muscle).

3 **The Rectum.**—The rectum is continuous superiorly with the pelvic colon. It constitutes that part of the large intestine which is fixed within the cavity of the true pelvis, and for descriptive purposes is divided into two stages. The first stage commences a little to the right of the mesial plane at the level of the third sacral vertebra, and terminates one inch beyond the tip of the coccyx. It follows the curve of the sacrum, the coccyx, and the ano-coccygeal body throughout, and is in relation posteriorly to these structures. In front, this stage is covered with peritoneum as far down as the level of the fifth piece of the sacrum, at which point the peritoneum leaves it, and is reflected on to the posterior vaginal wall, forming the recto-vaginal pouch. Below this, the anterior wall of the rectum is in direct relation with the posterior aspect of the vagina and with the perinæal body. On each side the rectum is covered by peritoneum above, and is supported by the levator ani muscle below. The second stage commences at a point an inch beyond the tip of the coccyx, and passes almost directly backwards to the anus, so that its axis forms nearly a right angle with the axis of the first stage. It is known as the anal canal, or, on account of the muscles by which it is surrounded, as the sphincteric zone of the rectum. Above and behind, it is in relation to the ano-coccygeal body, and below and in front, it is separated from the vagina by the triangular perinæal body.

THE PELVIC FLOOR AND MUSCLES

A thorough knowledge of the soft parts, which fill in the outlet of the pelvis and constitute the pelvic floor, is of great importance to the obstetrician, since they not only form the inferior wall of the whole abdominal cavity and support the downward pressure of the viscera,* but they also form the true boundaries of the lower portion of the canal through which the child must pass in parturition, and by their presence diminish the diameter of that canal. During parturition, these soft parts are greatly compressed and undergo a change of position, which is the direct result of the anatomical disposition of the various structures. All the soft parts of the outlet collectively form the pelvic floor, but anatomically it is customary to divide them into two parts:—

I. The structures which lie superficial and inferior to the pelvic diaphragm and constitute the perinæum.

II. The pelvic diaphragm, a muscular partition which stretches across the pelvic cavity, and divides it into an upper abdominal and a lower perinæal part.

For purposes of description it is convenient to follow this plan.

I. **The Perinæum.**—The perinæum is the lozenge-shaped area, bounded by the structures which surround the outlet of the pelvis, and is divided into a posterior rectal, and an anterior urogenital, triangle, by a line drawn transversely between the tubera ischii and just in front of the anus. This method of division is convenient, inasmuch as it includes the whole of the vagina within one triangle, but it does not correspond to a division which, on physiological grounds, is made of the whole pelvic floor, into an anterior and a posterior segment. According to this latter division, all the structures contained within the urogenital triangle lying posterior to the anterior vaginal wall, together with the structures of the rectal triangle, comprise the posterior segment, while the anterior vaginal wall and the structures in front of it constitute the anterior segment.

The rectal triangle contains the anal orifice and the lower portion of the rectum, the latter being bounded on each side by a fossa, the ischio-rectal fossa, filled with a large pad of fat. The anal orifice is, in the erect position, directed almost horizontally backwards, and is separated from the tip of the coccyx by the ano-coccygeal body, a mass of dense connective tissue into which some fibres of the levator ani muscle pass from above. In front, the anus is separated from the vaginal orifice by the wedge-shaped perinæal body. Into this body (the obstetrical perinæum) the anterior rectal and the posterior vaginal walls extend from above, together with a few fibres of the levator ani muscle which pass inwards from both sides. Within it, tendinous fibres of several of the superficial perinæal muscles arise, the fibres being blended together at the place of origin so as to form a tendinous mass, which constitutes a fixed point from which all the muscles act, and which in consequence is termed the central point of the perinæum. The fat within the ischio-rectal fossa is capable of altering its shape and position under the influence of pressure, and accommodates itself to changes in the state of distension of the rectum and of the vagina. The fossa itself is pyramidal in shape, and lies on the inner side of the body of the ischium. Its inner boundary is formed by the pelvic diaphragm.

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* Owing to the contractile power of most of the abdominal parietes, the pressure of the viscera is conveyed to the abdominal walls in a manner analogous to what would occur if the abdomen were a closed vessel filled with fluid —i.e., in the form of fluid pressure.

The urogenital triangle contains the urethral and vaginal openings, and is divided into a superficial and a deep compartment by the triangular ligament. This ligament fills up the subpubic space, and is attached on each side to the rami of the pubis and ischium. Posteriorly, it ends by a free margin, which is prolonged in the mesial plane into the perinæal body. It is perforated by the urethral and vaginal canals, to both of which it gives support as they pass towards the surface. In the superficial compartment there lies on each side of the vagina the bulb of the vestibule, over which are spread the fibres of the bulbocavernosus muscle. This compartment also contains the crura clitoridis, attached to the sides of the pubic arch, and covered by the erector clitoridis muscles. A third muscle—the transversus perinæi—lies along the base of the triangular ligament. It arises

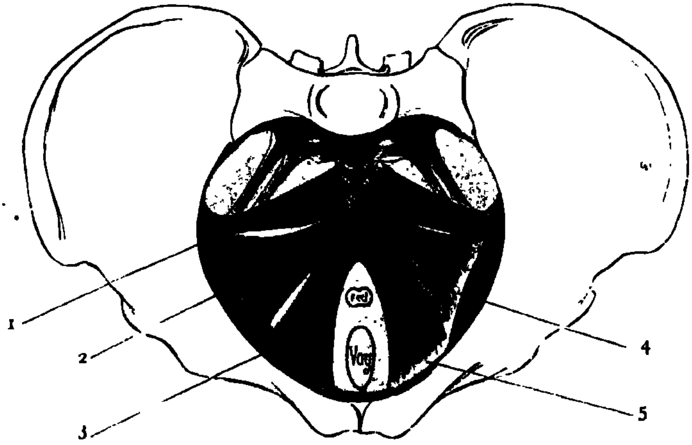

FIG. 41.—PELVIC DIAPHRAGM FROM ABOVE.
1, Ischio-coccygeus; 2, obturato-coccygeus; 3, pubo-coccygeus; 4, 5, linea alba. (Bumm.)

rom the ascending ramus of the ischium on each side, and its two heads passing inwards, unite to form a tendon which is blended with the central point of the perinæum. This muscle is the first to tear in ruptures of the perinæum, and the pull of its fibres aids in preventing the two sides of the rupture from coming together.

The deep perinæal compartment is contained between the triangular ligament and that portion of the parietal pelvic fascia which is carried across the subpubic space. It contains a portion of the urethra and vagina, together with the compressor urethræ muscle and the pudic vessels and nerves. Within this compartment also lie the glands of Bartholin. The compressor urethræ muscle exerts a sphincteric action upon both the vagina and urethra. Arising from the side of the pubic arch, it passes inwards, and divides into an upper (anterior) and a lower (posterior) part. The upper portion passes in front of the urethra, and meets its fellow of the opposite side in the middle line; the lower part turns backwards on the side of the vagina, and blends posteriorly with its fellow, so as to form an almost complete muscular circle around the vagina. When the layer of pelvic fascia which forms the deep boundary of the deep perinæal compartment is removed the levator ani muscle is exposed both in front, between the urethra and the subpubic angle, and on each side of the vagina.

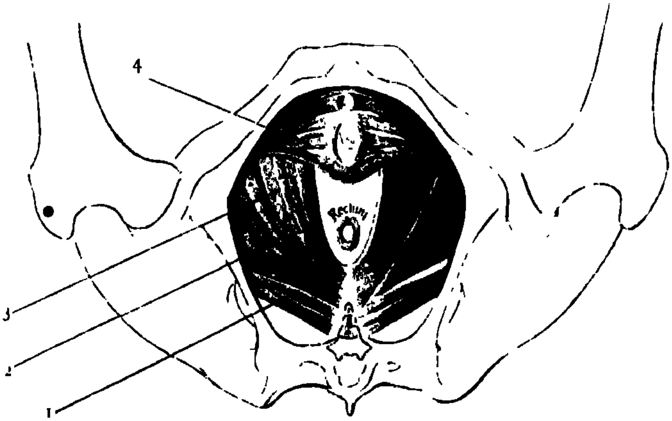

Fig. 42.—Pelvic Diaphragm from Below.
1, Ischio-coccygeus; 2, obturato-coccygeus. 3, pubo-coccygeus, 4, perinæal muscles. (Bumm.)

We have now passed rapidly under survey the structures which lie below the pelvic diaphragm, and have seen how the levator ani muscle is related to both the posterior and anterior triangles of the perinæum. We may, therefore, now proceed to consider the pelvic diaphragm itself.

The Pelvic Diaphragm.—On looking from above into a pelvis from which the upper portions of the viscera have been removed at the level at which they leave the abdominal portion of the pelvis and pass into the perinæum, the floor will present a funnel-shaped appearance, and at the apex of the funnel there will be seen in section from before backwards the canals of the urethra, the vagina, and the rectum. The floor or diaphragm is formed of two muscles on each side—the levator ani and the coccygeus—which arise from the anterior and lateral aspect of the pelvic walls, and pass downwards and inwards towards the mesial plane. Approaching the mesial plane, the middle portion of the diaphragm is prolonged downwards on each side of the rectum, and to a less extent upon the vagina, and thus gives rise to the funnel-shaped appearance.

The levator ani muscle arises from the posterior part of the symphysis pubis, and from a band of fascia (the linea alba), which, lying upon the obturator internus muscle externally, extends from the symphysis to the spine of the ischium. The fibres which arise from the symphysis pass backwards and inwards from their origin, and form the pubo-coccygeus muscle of Savage.* Three main sets of fibres may be recognised in this muscle:—(1) An internal group, which passes from the origin downwards and inwards by the side of the urethra and the vagina. A few fibres of this group turn inwards between the vagina and rectum, to meet similar ones from the opposite side, and thus support the vaginal wall posteriorly, and are inserted below into the perinæal body. This portion of the muscle is said to exert a sphincteric action upon the vagina. (2) A middle group, which passes downwards and inwards by the side of the rectum, and blends below with the sphincters of the anal canal. This portion of the muscle forms the internal boundary of the ischio-rectal fossa. (3) An external group, which passes backwards and inwards, and is inserted partly into the side of the lower portion of the coccyx, and partly into a median raphe, which extends from the tip of the coccyx to the rectum, and in which it blends with the muscle of the opposite side. The pubo-coccygeus muscle as a whole is of a triangular shape, with its apex above at its origin, and with a widely outspread insertion which extends from the urethra to the coccyx. The portion of the levator ani muscle which has a fascial origin (obturato-coccygeus muscle) is, on the contrary, wide above at its origin, and its fibres converge inferiorly, to be inserted into the side of the lower portion of the coccyx.

The coccygeus muscle (ischio-coccygeus) is a small triangular muscle lying on the deep surface of the lesser sacro-sciatic ligament. It arises by its apex from the spine of the ischium, and by its base is inserted into the side of the lower part of the sacrum and upper part of the coccyx. It completes the pelvic diaphragm posteriorly.

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* Savage, 'Female Pelvic Organs,' third edition, p. 2 *et seq.*

The floor of the pelvis, constituted as above described, is divided into a pubic and a sacral segment by the transverse slit formed by the vagina. The pubic segment is triangular in shape. It includes the anterior vaginal wall and that part of the floor which lies anterior to it. The sacral segment comprises the remainder of the floor, including the posterior vaginal wall, and is roughly quadrilateral in shape.

This division into two parts is justified by the different behaviour of the two segments during parturition. When the muscular wall of the uterus commences to contract and retract, it exerts a direct pull upon the lower uterine segment and vaginal canal, while at the same time the advancing fœtus exerts a downward pressure upon the same segment. The result is that, during the first and second stages of labour, the vaginal walls glide apart from one another; the anterior, together with the pubic segment of the pelvic floor, is pulled upwards and forwards, and the posterior, along with the sacral segment, is pushed downwards and backwards, so that the transverse slit made by the vagina in the pelvic floor becomes converted into an elongated oval aperture, the long axis of which is antero-posterior. As labour proceeds, the pubic segment becomes more and more drawn upwards and pressed forwards against the pubes, and consequently appears shortened. The posterior segment, on the contrary, is lengthened. Its upper part, along with the lower portion of the rectum, is pressed almost directly backwards, and its lower part becomes flattened out before the advancing head. The anterior boundary of the complete segment is formed by the greatly stretched transversus perinæi muscle and by that part of the triangular ligament which lies posterior to the vaginal orifice.*

The Muscles and Cellular Tissue within the Pelvis.—An account of the pelvis from the obstetrical point of view would not be complete without a brief reference to the muscles and cellular tissue contained within it, since the former modify to a slight extent the lengths of the pelvic diameters, and the latter acts as supporting tissue for the structures contained within the cavity.

The Iliacus Muscle.—This arises from that part of the iliac bone which bounds the false pelvis. Its fibres gradually converge, and leave the pelvis by passing under Poupart's ligament. They are inserted into the outer margin of the tendon of the psoas muscle.

The Psoas Muscle.—This arises from the bodies and transverse processes of the lumbar vertebræ, and passes downwards on the inner side of the iliacus to its insertion into the femur. As it skirts the brim of the pelvis it slightly overlaps the ilio-pectineal line, and, taken together, the two psoas muscles diminish the transverse diameter of the inlet by about half an inch.

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* For further information, see under Mechanical Phenomena of Labour.

The Pyriformis Muscle.—This lies in relation to the posterior pelvic wall. It arises from the front of the middle three pieces of the sacrum external to the anterior sacral foramina, and leaves the pelvis through the great sacro-sciatic foramen. Together with the sacral nerves and a number of arteries, it fills in the gap left by that foramen in the posterior part of the pelvis.

The Obturator Internus.—This is a fan-shaped muscle which lies in relation to the anterior and lateral pelvic wall, covering over the thyroid foramen. It arises from the body of the ischium, the margins of the thyroid foramen, and from the thyroid membrane, and its tendon leaves the pelvis through the small sacro-sciatic foramen. Its upper part lies above the level of the origin of the levator ani muscle, and is consequently in relation to the true pelvis; its lower part lying below the levator ani, bounds the ischio-rectal fossa externally.

The Pelvic Cellular Tissue.—All the structures within the pelvis are closely bound together by the pelvic cellular tissue, which is composed of ordinary fibrous tissue largely intermixed with elastic fibres and involuntary muscular tissue. Its arrangement is very complex, but it may be regarded as being arranged in two distinct bands, which help to suspend the uterus within the pelvic cavity, acting upon it as so many lines of tension.[*] These two bands are called from their position the pubo-sacral and the utero-iliac. The former band runs in an antero-posterior direction and comprises the tissue contained within the utero-sacral ligaments, that which binds the vagina and uterus to the bladder and urethra, and also the tissue which lies between the bladder and the pubis. The latter band runs transversely, accompanying the uterine vessels in the broad ligament, and passing from either side of the uterus to the lateral pelvic wall.

THE MAMMARY GLANDS

The mammary glands, and the purpose they serve of feeding the young in the early days of extra-uterine life, are a distinguishing characteristic of the class mammalia. Though epiblastic in origin, these glands must be regarded as an essential part of the female reproductive organs. Their intimate physiological connection with the uterus and ovaries is shown by the changes which they undergo during pregnancy and menstruation, and by alterations which sometimes occur in them in association with pathological conditions in these organs.

When fully developed in the human female, they form hemispherical elevations placed on each side of the front of the thorax.

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[*] Savage, 'Female Pelvic Organs,' third edition.

and extending in a vertical direction from the second rib above to the seventh costal arch below; in a transverse direction they extend from the lateral margin of the sternum to the mid-axillary line, so that the lower margin of the pectoralis major muscle divides each gland into an almost equal upper and inner pectoral part, and a lower and outer axillary part.

Each gland lies embedded in the subcutaneous tissue, which not only covers it superficially and separates it from the subjacent muscles, but also extends into the intervals between the lobes

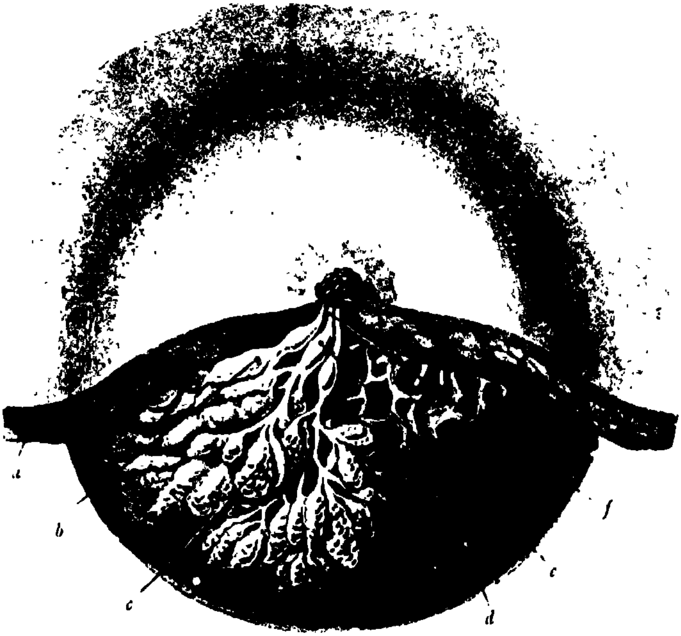


FIG. 43.—MAMMARY GLAND DURING LACTATION
a, Fat; b, lobule unravelled; c, lobule, d, loculi in connective tissue, e, ampulla; f, duct. (Luschka)

and lobules, and thus gives it its smooth and rounded appearance. Processes of the gland, however, often project for a considerable distance from the main mass into the surrounding fibrous and adipose tissue.

On the summit of each gland is placed a small cylindrical elevation—the nipple or mamilla—and this is situated at about the level of the fourth intercostal space and four inches from the middle line. The colour of the skin covering the nipple is, as a rule, rose-pink in nulliparæ, but varies somewhat with the complexion of the individual, being slightly darker in brunettes than in blondes. Surrounding the nipple for a distance of about half an inch is a circle of skin, the areola, which is coloured of the same hue as the nipple. Immediately deep to the areola, lie the dilated ampullæ of the mammary ducts, without any fatty tissue intervening. On its surface several small prominences or tubercles are visible. Some of these are formed by accumulations of large sebaceous glands—Montgomery's tubercles, the secretion of which helps to preserve the normal softness and elasticity of the integument; others are formed by the presence of small accessory milk glands; and others, again, mark the opening of some of the ducts of the mammary gland itself.

The glandular substance of the breast is encased in a sheath of fibrous tissue, which separates it from the surrounding fat and sends septa into the gland, so dividing it up into lobes and lobules. The lobes are from fifteen to twenty in number, and each possesses

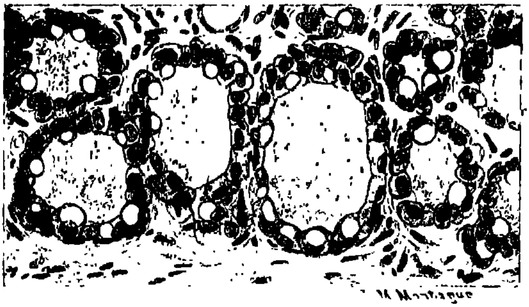


FIG. 44.—LACTATING BREAST.
Microscopical section showing the secreting acini. (W. Williams.)

a separate duct. All the ducts converge towards the nipple and they become dilated into ampullar spaces beneath the areola; then narrowing again, each duct passes to the summit of the nipple, where it communicates with the exterior by a very small opening. The wall of the duct is formed by connective tissue and elastic fibres arranged circularly and longitudinally, and is lined by a layer of low columnar epithelium. When the duct is traced to the surface, it is found that the epidermis extends into it for a short distance and replaces the columnar layer of cells. Traced in the opposite direction, each duct is found to divide and subdivide, till finally its terminal ramifications, lined by almost flat epithelium, open into acinous spaces which constitute the secreting substance of the mamma. In the virgin, the acini are supported by a basement membrane of connective tissue, and are lined by a layer of high columnar cells, which completely occlude the lumen, and which are composed of granular protoplasm. During pregnancy, the acini become much enlarged, and at the commencement of lactation are filled with a clear secretion, which by its pressure distends them and causes the lining cells to assume a flatter appearance. The inner margins of the cells at this time are ragged

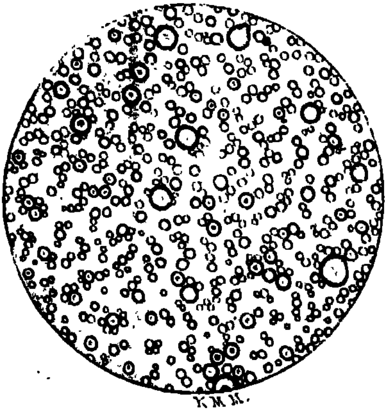


FIG. 45.—HUMAN MILK. (W. Williams.)

and contain numerous fat globules, which displace the nucleus and protoplasm outwards. When secretion is established, these fat globules escape from the cell into the lumen and form the

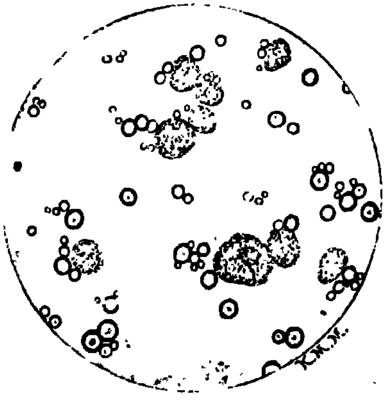


FIG. 46.—HUMAN COLOSTRUM. (W. Williams.)

characteristic milk globules. In addition to these structures, during the first few days of lactation large numbers of cells resembling white blood corpuscles and containing fat droplets are found within the acini. These are the so-called colostrum corpuscles, and are probably migrated leucocytes engorged with the fat secreted by the true glandular cells.

The mamma is supplied with blood by twigs from the internal mammary artery and by a large branch (the external mammary) of the long thoracic artery. The latter winds round the lower border of the pectoralis major muscle to reach the breast. It also receives twigs from the second, third, and fourth intercostal arteries. The veins in every respect correspond to the arteries. The nipple and areola are abundantly supplied with blood, a venous circle being formed around the base of the nipple, and at times a sort of semi-erection or venous turgescence of these parts can be produced by the contraction of involuntary muscular fibres which lie in the neighbourhood of the ampullæ. These fibres not only help to expel the contents of the ampullæ by their contraction, but also retard the return of venous blood by compressing the veins.

The lymphatic vessels are arranged in several groups within the gland, all of them, however, freely anastomosing with one another. The efferent trunks pour their contents into the sternal and axillary groups of lymphatic glands.

CHAPTER III

THE OVUM

The Early Ovum: Extrusion of Polar Bodies; Fertilisation, Segmentation; Blastodermic Vesicle; Formation of Embryo; Epiblast, Mesoblast, and Hypoblast; Formation of Amnion; Early Nutrition of Fœtus, Formation of Allantois—The Deciduæ—The Placenta—The Umbilical Cord—The Liquor Amnii.

THE following short account of the early development of the human ovum is not intended to be in any way complete, but will principally be concerned in showing the manner in which the fœtal membranes are developed, and in which the nutrition and growth of the fœtus is brought about at different stages of its existence. Many questions dealing with the exact mode of formation of such fœtal structures as the amnion and allantois are still unsolved owing to the difficulty of obtaining for examination human ova of a sufficiently early age. Of these the greater number, however, possess a purely morphological interest, and will not be discussed here, except in so far as they are of practical importance to the student of midwifery.

THE EARLY OVUM

The human ovum prior to fertilisation is a small spherical cell with a diameter of about 0·2 millimetre, and when first extruded from the Graafian follicle is surrounded by one or more layers of altered epithelial cells derived from the discus proligerus. The ovum itself possesses externally a limiting membrane, which from its clear appearance on section is known as the zona pellucida. Within this is contained the proper substance of the cell, the yelk or vitellus. The zona pellucida is derived from the ovum itself, but is non-adherent to the yelk, and in some stages of development can be observed to be separated from the latter by a perivitelline space. When examined under a high power of the microscope, a number of radiating striæ may be seen traversing it, which are supposed to indicate the presence of minute canaliculi, and this appearance has gained for it the alternative name of zona radiata. The vitellus is a yellowish semi-fluid substance composed of two different materials, the protoplasm proper, and the nutritive material or deutoplasm. The protoplasm, which constitutes its essential structure, forms a fine network within the cell, in the meshes of which are scattered numerous almost opaque fatty and albuminous particles. These latter provide a store of nutriment for the ovum in its earliest stage of existence, and to them collectively the term 'deutoplasm' is applied. They are small in amount compared with the deutoplasm in the ova of many other animals, and are almost equally distributed throughout the vitellus. Within the latter, and usually eccentrically placed there is found a large nucleus surrounded by a delicate limiting membrane. The nucleus, like that of other cells, is composed of a clear nuclear fluid, within which there is found a delicate reticulum of chromatin. The latter is especially accumulated at one place, where it forms the nucleolus or germinal spot. Occasionally more than one nucleolus is present.

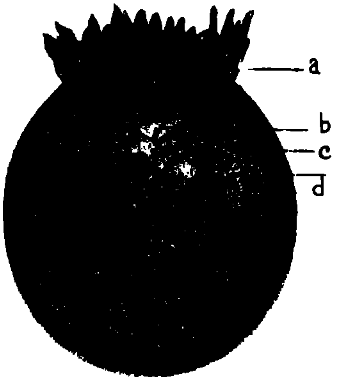


FIG. 47.—OVUM OF RABBIT.

a, Portion of discus proligerus ; *b*, nucleus containing nucleolus ; *c*, yelk containing deutoplasm ; *d*, zona pellucida. (Waldeyer.)

After the ovum has attained maturity, either before or immediately after its expulsion from the Graafian follicle, certain important changes take place in it, without the occurrence of which fertilisation can probably not take place. These changes consist in the extrusion of a portion of the nucleus and its contained chromatin out of the cell, and they commence by a contraction of the vitellus, with the result that the latter separates from the zona radiata, and leaves a distinct perivitelline space containing a clear fluid. At the same time, the margins of the nucleus become obscure, and the latter migrates towards the periphery of the cell, where it rapidly undergoes the usual changes prior to cell division (karyokinesis) and divides into two parts. One of these parts is expelled into the perivitelline space, while the other part returns into the cell and again undergoes karyokinetic changes, with the result that a half is again extruded; the remainder, which is now termed the female pro-nucleus, and represents one-quarter of the original germinal vesicle, gradually returns towards the centre of the vitellus, where it awaits the spermatozoon. The two parts of the nucleus which have been expelled are known as the polar globules, owing to the fact that in those ova in which the deutoplasm is accumulated at one pole (telolecithal ova) extrusion always takes place at the opposite or formative pole. They remain visible during the early stages of segmentation, but their ultimate fate and their significance is unknown. It is possible that by this removal of certain constituents of the female nucleus a more equal transmission of characteristics from both parents is assured.

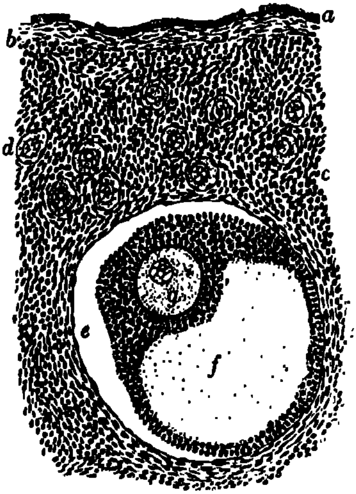


FIG. 48.—OVUM IN GRAAFIAN FOLLICLE.

a, Epithelium on ovary; *b*, tunica albuginea; *c*, stroma of ovary; *d*, immature ovum; *e*, theca of Graafian follicle; *f*, liquor folliculi; *g*, ovum. (Piersol.)

Fertilisation.—If impregnation occurs, numerous spermatozoa cluster around the germ-cell external to the zona pellucida, either during the process of expulsion of the polar globules or shortly afterwards. One of these, probably the first to approach the ovum, strikes the surface of the membrane with its head, and at the point of contact a small elevation forms. Through this the spermatozoon gradually bores its way into the cell. In many invertebrates a definite channel, the micropyle, exists in the limiting membrane, and through this the spermatozoon reaches the vitellus, but none has been demonstrated in the ova of mammalia. When the sperm-cell has completely penetrated into the vitellus, its tail ceases to vibrate and disappears, while the head and middle portion, which are both nuclear in origin, form a small spheroidal corpuscle, the male pro-nucleus. The latter moves towards the centre of the cell in the direction of the female pro-nucleus, exerting as it does so a peculiar influence upon the surrounding protoplasm, which becomes arranged in radiating lines around it. The female pro-nucleus also moves, though less actively, to meet it, and finally they come into close contact with one another, and become surrounded by a common radiation. An interchange of chromatic particles now takes place, though no actual fusion occurs, and it is probable that in each subsequent

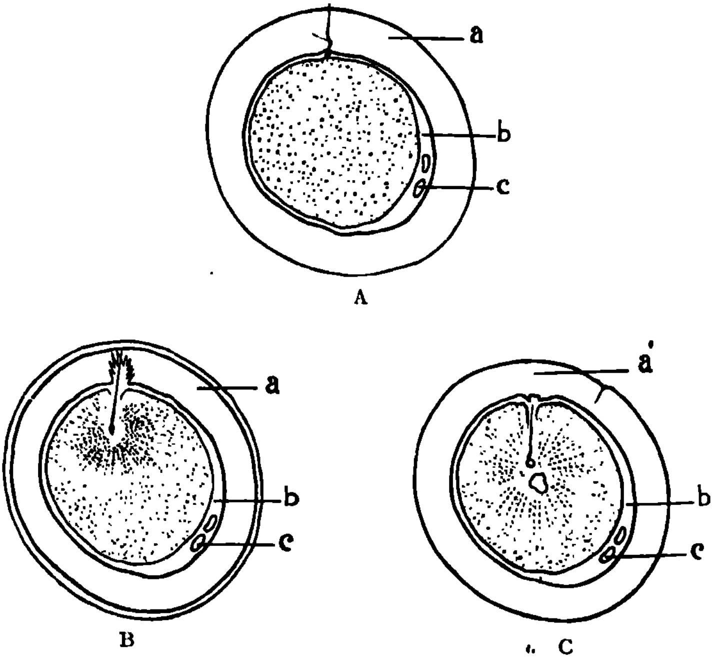


Fig. 49.—Diagrams to show Fertilisation of the Ovum.

a, Zona pellucida; *b*, perivitelline space; *c*, polar globules.

In A, the spermatozoon has approached ovum; in B, the radial disposition of the yelk is seen; and in C, the male pro-nucleus is approaching the female pro-nucleus. (Selenka.)

division of the combined nucleus a portion of both the male and female element passes into each cell.

Segmentation.—A short period of rest follows upon the fusion of the male and female pro-nuclei, and then the process of segmentation commences. The ovum first divides into two cells, and then each of these again rapidly divides into two more. This process repeatedly occurs until a cluster of cells is formed contained within the vitelline membrane, and this from its appearance is called the mulberry mass, or morula. The outer cells of this mass are seen to be smaller and less granular than the inner cells, which are larger and darker in appearance. The former also after a time undergo more rapid proliferation, so that ultimately they form a complete investing membrane around the others.

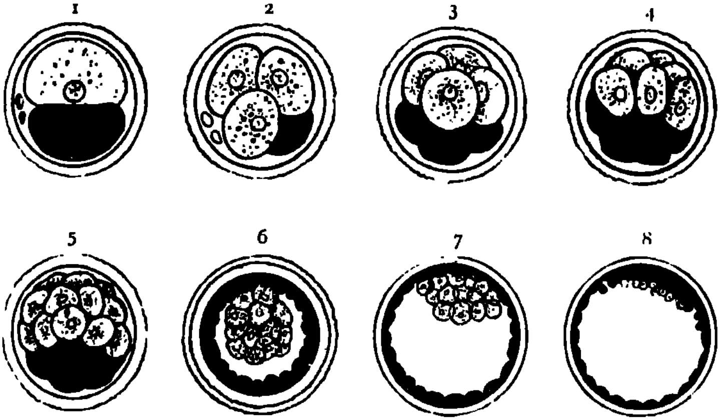


Fig. 50.—Diagrams showing Segmentation of a Mammalian Ovum, and the Formation of the Blastodermic Vesicle.

Nos. 1-4 represent the early stages in division of the ovum. No 5 represents the morula stage; in No. 6 the effusion of fluid and commencement of formation of the blastodermic vesicle is shown, and in Nos. 7 and 8 the gradual spreading out of the inner layer of cells is represented. (Allen Thomson, after van Beneden)

The Blastodermic Vesicle.—A cleavage cavity is now formed within the centre of the morula by the effusion of fluid and the separation of the cells, and, gradually increasing in size, the morula is converted into a large thin-walled sac bounded by the thinned-out zona pellucida, and by the layer of outer clear cells which have also become greatly thinned as a result of the pressure to which they have been subjected. Attached at one point to the inner surface of this limiting membrane, is found the group of large cells which previously occupied the entire centre of the morula. This stage of the ovum is known as the blastula stage, and it is in turn converted into the bi-laminar blastodermic vesicle by the spreading out of the cluster of dark cells upon the inner surface of the external layer. As these cells proliferate and extend outwards on each side they become differentiated into two distinct layers—an outer, composed of primitive epithelioid cells, the primitive ectoderm or epiblast, and an inner layer of flattened cells, the primitive entoderm or hypoblast. The original layer of clear cells, which at first lay in contact with the zona pellucida, entirely disappears.

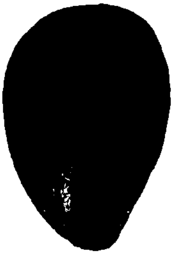


FIG 51.—EMBRYONIC AREA, SHOWING PRIMITIVE STREAK AND GROOVE (Quain.)

Formation of Embryo.—Long before the blastoderm is completely formed by the extension round it of the primitive epiblast and hypoblast, changes occur at the place where the cluster of dark cells was attached, and lead to the differentiation of the embryo from the remainder of the ovum. Over a somewhat oval area in this situation, the germ layers, more especially the ectoderm, become thickened, and the cells of which they are composed become more tightly packed together, so that this area

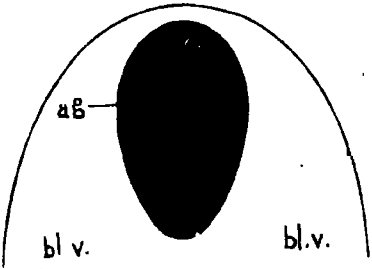


FIG. 52.—EMBRYONIC AREA FROM RABBIT'S OVUM.

rf, Neural groove; *bl. v.*, blastodermic vesicle; *pr*, primitive groove; *ag*, embryonic area. (Kolliker.)

becomes more opaque than surrounding parts. To this is given the name of embryonic area in consequence of the part which it plays in the further development of the embryo. Over the posterior part of this area a dark spot of crescentic form appears, the concavity of which is directed forwards. This marks the place at which the two layers of cells have become continuous with one another, and, passing forward from it along the embryonic area, there is very shortly seen an opaque line, along which a similar fusion of cells has occurred. This line is known as the primitive streak, and it is grooved along its upper surface, by the primitive groove. If sections are now made through the embryonic area across the line of the primitive streak, it will be seen that on each side of the latter a third layer of cells has made its appearance between the two previously existing layers. The exact origin of this middle stratum, which is called the mesoblast, is still a matter of considerable doubt, but it is most

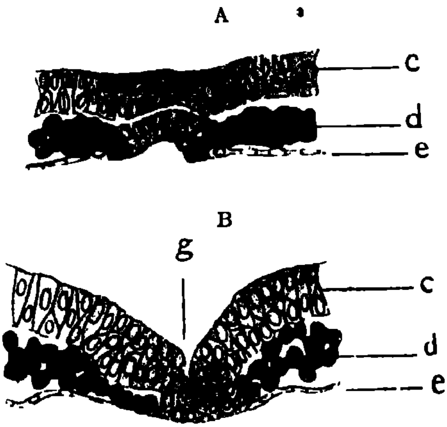


Fig. 53.—Sections through Embryonic Area, showing the Formation of the Mesoblast on Each Side of the Primitive Groove.

g, Primitive groove; c, epiblast; d, mesoblast; e, hypoblast. (Heape.)

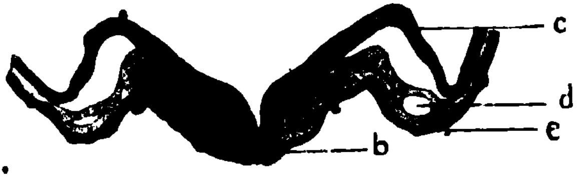


Fig. 54.—Section through Medullary Groove of an Early Embryo.

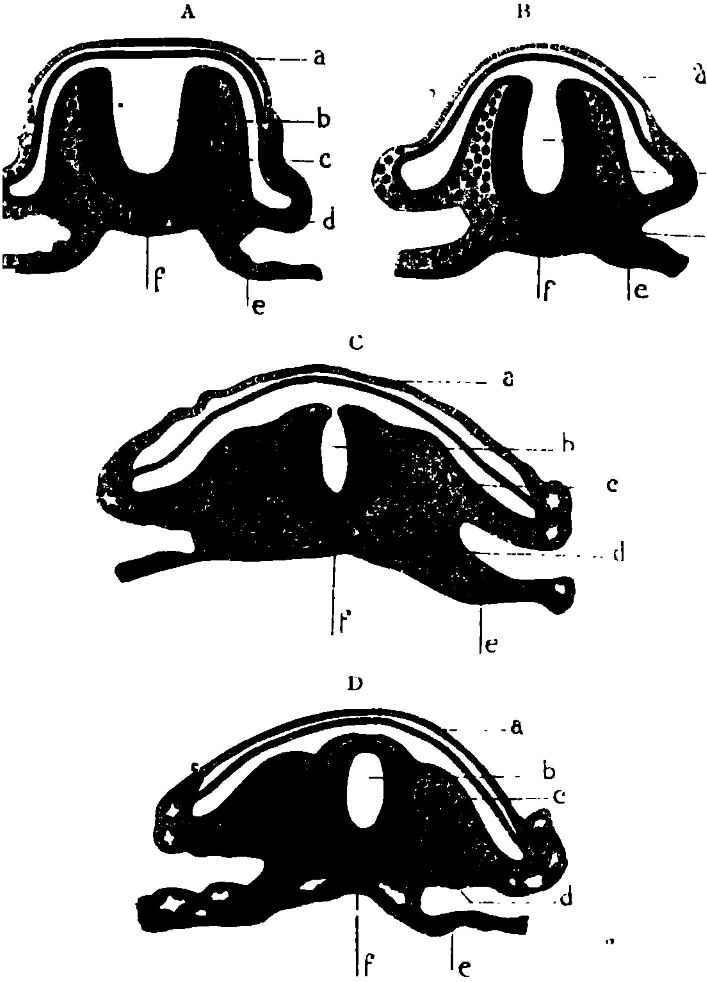
c, Epiblast; d, mesoblast; e, hypoblast; b, neural groove. (Quain.)

probable that it is derived by proliferation of the cells of both the epiblast and hypoblast along their line of union, and that originating in this way they spread out on each side and also forwards, separating the two original layers, and thus giving a tri-laminar structure to the previously bi-laminar blastoderm.

'Immediately in front of the primitive streak, and within the limits of the embryonic area, the first rudiment of the embryo makes its appearance in the form of a groove, which, since it becomes later developed into the nervous system, is called the neural groove. This groove, which must be carefully distinguished from the primitive groove, is formed during the growth of the mesoblast by the proliferation of the cells of the epiblast. The proliferation causes the epiblast to become raised up into two longitudinally running folds, which enclose between them the groove, and are termed the neural or medullary folds. The groove is wide posteriorly where it embraces the anterior extremity of the primitive streak, but narrows in front, where the two folds which bound it laterally become united with one another to form its anterior limit. Meanwhile, the mesoblast has been extending forwards, and, as soon as the medullary folds are formed, it insinuates itself into them on each side between the epiblast and the hypoblast, so as to form ridges of mesoblast triangular on cross-section, lying on each side of the neural groove, and separated from one another in the middle line by the union of epiblast and hypoblast at the bottom of this groove. These ridges are known as the par-axial mesoblast, in contradistinction to the remainder of that layer, which extends as a flattened plate on each side, and is termed the lateral mesoblast.

The par-axial mesoblast soon becomes divided up into a series of segments by a process of thinning, which occurs at regular intervals across it, forming the protovertebral or mesoblastic somites, which in their further development form the vertebral column, the muscles of the trunk, and those of the extremities. The lateral mesoblast undergoes a different change. By the effusion of fluid between the cells of which it is composed, it becomes separated into two layers, of which the outer, known as the somato-pleural layer, adheres to the epiblast, and forms the connective-tissue structures of the body wall. The inner, known as the splanchno-pleural layer, adheres to the hypoblast, and forms the muscular and connective tissue of the abdominal and thoracic viscera. The space which separates the two layers is the first appearance of the cœlom or body cavity, which subsequently becomes divided into various compartments, and forms the large serous cavities.

Meanwhile, by a gradual infolding of the ridges which bound the neural groove, the latter has been converted into a closed tube —the neural canal—which is at first in contact with the external layer of epiblast, but is later separated from it by the growth of processes of the par-axial mesoblast dorsalwards between it and the urface layer. The neural canal is the rudiment from which the hole of the nervous system, both central and peripheral, is



55.—SECTIONS SHOWING STAGES IN CONVERSION OF MEDULLARY GROOVE INTO NEURAL CANAL.

Mesoblast of amnion. *b*, neural groove. *c*, epiblast. *d*, mesoblast. *e*, hypoblast. *f*, notochord.

eloped. It marks the long axis of the body, and immediately acent to it there lies a longitudinally-running column, circular in transverse section, which is called the notochord, or chorda dorsalis. This has been produced by a thickening of the hypoblast, and becomes separated both from the subjacent hypoblast and from the neural canal by the ingrowth of processes of the mesoblast. It is the precursor of the vertebral column.

Before going further, it may be well to enumerate the various tissues and organs which are developed out of the three primitive layers of the embryo. For convenience they may be arranged in a tabular form :—

Epiblast	The epidermis and its appendages. The nervous system. The epithelium of the mouth, nose, anal canal, and vagina. The epithelium of the sebaceous glands, sweat glands, and mammary glands. The epithelium of the eye and ear.
Mesoblast	The supporting and connective tissues of the body. The vascular and lymphatic system. The urinary and generative organs, with the exception of the epithelium lining the bladder and urethra and the germinal cells. The spleen.
Hypoblast	The epithelium of the alimentary canal and of the glands whose ducts open into it. The epithelium of the thyroid and thymus glands. The epithelium of the bladder and urethra. The cells of the Graafian follicles and seminiferous tubules. The epithelium of the air-passages.

Formation of Amnion.—The embryo represented by the neural canal, the notochord and the mesoblastic somites, has up to this been lying on the same level as the general surface of the blastodermic vesicle, but it soon becomes marked off from the latter by the development of limiting furrows around it. These furrows are produced by a dipping inwards of the somatopleure all round, and the various folds thus produced grow in to meet one another on the under surface of the embryo. In accordance with the fact that the head end of the embryo always anticipates in development the other parts, this groove first makes its appearance in front of the neural canal (anterior limiting sulcus), and then, as the process of enfolding gradually extends to the sides, lateral limiting sulci are produced, which at a still later period become united behind the tail end of the embryo by their extension to form a posterior limiting sulcus. The completed circumferential furrow marks out the elongated and somewhat tubular-shaped embryo from the surrounding blastoderm, and as during its growth the latter, from its greater weight, sinks downwards, the part of the somatopleure which bounds the furrow externally becomes raised up in the form of a definite ridge, which appears to be reflected upwards from the bottom of the furrow. As the grooves deepen they present an appearance as if the somatopleure was being tucked in beneath the embryo—*i.e.*, on its ventral aspect—and as they approach one another they cause a portion of the general cavity of the blastodermic vesicle to be enclosed in this position. As we have already seen, the cavity of the blastodermic vesicle is lined internally with hypoblast, and the portion of it which is in this way separated off forms the primitive alimentary canal. This consists of an anterior fore gut, which

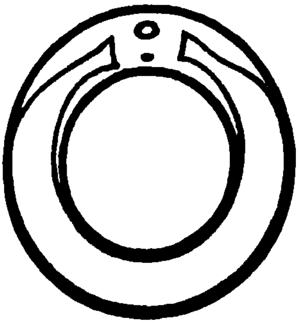


Fig. 56.—Diagrammatic Section through Ovum, showing the Neural Canal and Notochord, and also the Division of the Mesoblast into its Outer Somato-pleural, and Inner Splanchno-pleural Layers.

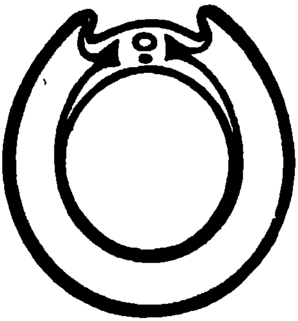


Fig. 57.—Diagram to show Commencement of Formation of the Amnion.

The somatopleure is raised up on each side of the embryo in the form of limiting ridges.

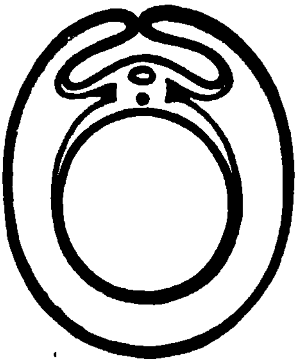


Fig. 58.—A Later Stage than Fig. 57.

The limiting ridges are meeting above the back of the embryo.

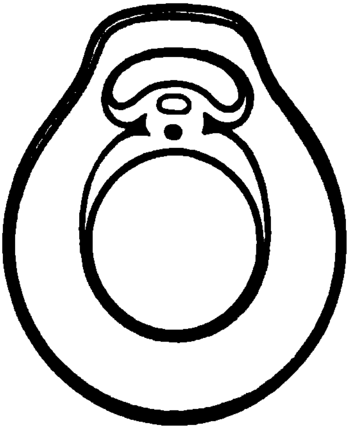


Fig. 59.—Complete Formation of Amnion and Chorion.

The amnion is the small sac on the dorsal aspect of the embryo, and the chorion is the large outer sac.

terminates blindly beneath the head end of the embryo, and is bounded by the anterior limiting sulcus; of a posterior hind gut, which also terminates blindly in the tail end of the embryo, and is bounded by the posterior limiting sulcus; and of a middle portion—the mid gut—which communicates by means of a wide aperture with the remaining portion of the blastodermic vesicle. To this extra-embryonic part of the blastodermic vesicle the name of yolk sac is applied. By the gradual deepening of the limiting sulci, the foramen, through which the sac is at first continuous with the mid gut, becomes narrower, and is finally converted into a narrow canal—the vitelline duct.

Meanwhile, the ridges of somatopleure, formed by the sinking in of the embryo towards the blastodermic cavity, have been increasing in height, and have begun to grow dorsalwards over

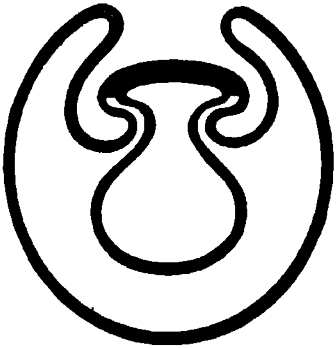


FIG. 60. DIAGRAMMATIC LONGITUDINAL SECTION THROUGH EMBRYO, SHOWING THE AMNIOTIC RIDGES AND THE GRADUAL CLOSING IN OF THE ANTERIOR AND POSTERIOR LIMITING SULCI ON THE VENTRAL ASPECT OF THE EMBRYO.

the embryo. The ridge which is in front of the head end of the embryo is at first most marked, and from there grows back as a covering over its dorsum, to meet with the lateral and posterior portions of the ridge, which grow over in a similar manner, though at a somewhat later date. The free edges of the several folds for a time bound a circular foramen over the centre of the embryo, but finally meet with one another, and having completely fused, become divided into two distinct membranes by the recession of the outer from the inner layer. The external membrane, composed of an outer layer of epiblast and an inner layer of mesoblast, is continuous with the general somato-pleural wall of the blastoderm, and is called the chorion. The inner lamina, composed of an outer layer of mesoblast and an inner layer of epiblast, is called the amnion, and surrounds a space over the dorsal region of the embryo, called the amniotic cavity. This cavity is at first small, in comparison with the cavity of the chorion, in which it is contained; but as the yolk sac atrophies, the amniotic cavity increases in size by the accumulation of fluid within it, and comes to occupy the whole of the chorionic cavity, and the amniotic and chorionic membranes come into contact with one another. This distension of the amniotic cavity is, however, not completed till a much later date. The fluid which it contains is called the liquor amnii, and will be described subsequently.

The Early Nutrition of the Fœtus.—It is in connection with the yolk sac that the first evidence of a fœtal circulation is manifested. Prior to its formation, the ovum is nourished by direct absorption from the uterine decidua, in which it is embedded, probably partly through the agency of structureless villi, which are formed upon the zona pellucida. In many animals also the ovum during its passage through the Fallopian tubes becomes surrounded by an albuminous envelope, derived from the secretion of the cells lining the tubes, and this contributes to its nourishment.

Vitelline Circulation.—During the changes which have resulted in the formation of the yolk sac, a simple heart has become developed in the splanchno-pleural mesoblast beneath the head end of the embryo, in the form of two tubes, which meet with one another in the middle line, and fuse so as to form a single canal, the long axis of which is directed antero-posteriorly. From the cephalic extremity of this tube, a single arterial trunk passes forwards for a short distance, and bifurcates in the region of the first visceral arch into two branches, which pass backwards along the side of the fore gut, and on reaching the dorsum of the embryo turn downwards towards its posterior extremity, constituting what are termed the primitive aortæ. From these trunks, lateral branches are given off to the yolk sac, and anastomose on its surface, so as to form a complete circle around its upper part. From this ring, or *sinus terminalis*, as it has been called by His, numerous smaller twigs pass on to the surface of the sac, and break up into capillaries, from which the blood is again collected into two large venous channels the vitelline veins. These latter pour their blood into the posterior extremity of the tubular heart. As soon as the heart makes its appearance it is seen to be actively contracting and to be driving blood along the arteries to the yolk sac. The blood absorbs nourishment from the rich albuminous fluid contained within the latter, and conveys it back along the veins to the heart. This primitive circulation is a very temporary and unimportant provision in Mammalia, and is soon replaced by the secondary, or placental, circulation.

Formation of the Allantois.—As soon as the chorion is formed, villi, which are at first non-vascular, develop over the greater part of its surface by the rapid proliferation of the epiblastic cells which form its outer layer and which project into little depressions of the uterine mucous membrane lying between the uterine glands Probably these villi are able to absorb directly some nourishment from the uterine lymphatics. As soon as the allantois becomes developed, however, the chorion and its villi become altered. The allantois is primarily formed as a hypoblastic diverticulum from the ventral surface of the hind gut of the embryo, and projects outwards into the space of the chorionic cavity, which is unoccupied by the amnion and the yolk sac. Its function is two-fold, first to form the urinary bladder, and, secondly, to aid in the formation of the placenta. It is with the latter function that we are at present principally concerned.

The outer surface of the hypoblastic sac is covered with a layer of splanchno-pleural mesoblast, which in man and in most mammalia gradually outstrips in growth the hypoblast, and forms the greater part of the structure. It rapidly extends in the form of a solid stalk till it reaches the deep surface of the chorion, to which it conveys bloodvessels which have passed into it on each side from the primitive aortæ. These vessels, which are termed the umbilical arteries, at once break up into numerous branches, and the latter are distributed to the chorionic villi. According to many observers, however, the allantois appears at such an early date in the human embryo that its mesoblast is never separated from the mesoblast of the chorion, owing to the late development of the posterior amniotic fold.

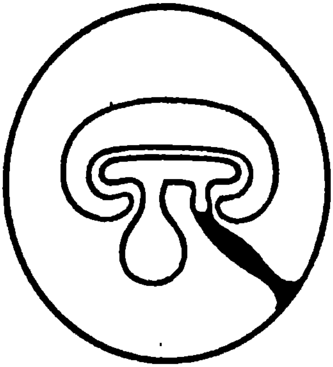


FIG. 61.—DIAGRAM TO SHOW THE FORMATION OF THE ALLANTOIS AS A DIVERTICULUM FROM THE HIND GUT OF THE EMBRYO.

The solid column represents the mesoblastic stalk, which extends to the inner surface of the chorion. The amnion is also shown on the dorsum of the embryo.

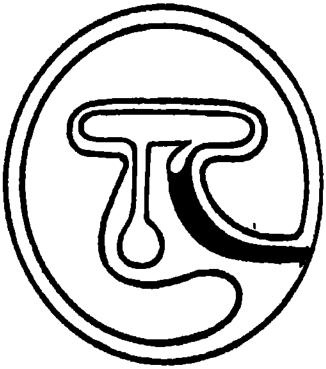


FIG. 62.—A LATER STAGE THAN FIG. 61.

The amnion has enlarged, and is now almost co-extensive with the chorion. In consequence of the closing in of the limiting sulci the allantoic diverticulum has become oblique. The vitelline duct and the yolk-sac are also represented.

The place where the allantoic stalk first abuts against the chorion corresponds to the future situation of the placenta, and over this region the villi become very much enlarged, and side branches develop on the main stems, to each of which arterial twigs are given off. This region is consequently known as the chorion frondosum, to distinguish it from the remainder of the chorionic surface, which is called the chorion læve. Over the latter area, the villi soon cease to grow and in part atrophy, though occasionally some of them increase in size, and establish a firm union with the uterine mucous membrane.

THE DECIDUÆ

The term decidua is applied to the greatly hypertrophied mucous membrane of the uterus during pregnancy, owing to the fact that it is exfoliated along with the fœtal membranes at the close of gestation.

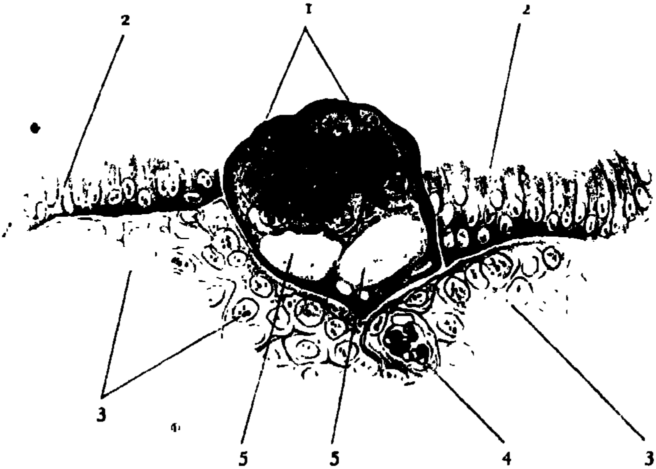


FIG. 63.—IMPLANTATION OF OVUM ON THE DECIDUA.

1, Ovum; 2, uterine epithelium; 3, connective-tissue cells of decidua; 4, capillary vessels; 5, large clear cells of ovum. Observe the way in which the ovum has sunk through the epithelium and come in contact with the underlying connective tissue. (Grafspee.)

Mammalia have been divided into two main classes, nondeciduate and deciduate, according to the method of attachment of the placenta to the uterine wall. In the former class, which includes ruminants, the placenta is represented by isolated groups of chorionic villi which have only a loose attachment to the mucous membrane of the uterus, and, consequently, during the expulsion of the contents of that cavity they can become detached without any exfoliation of the mucous membrane taking place. In the latter class, the union of the chorionic villi with the uterine mucous membrane is much more intimate, so that when separation occurs a part of the membrane comes away with the fœtal structures and forms an essential part of the entire placenta. In fact, the separation takes place not between the fœtal placenta and the uterine wall, but through the mucous membrane itself. In the human female the separation is still more extensive, since the superficial part of the whole lining membrane of the uterus, in addition to the placental part, is expelled.

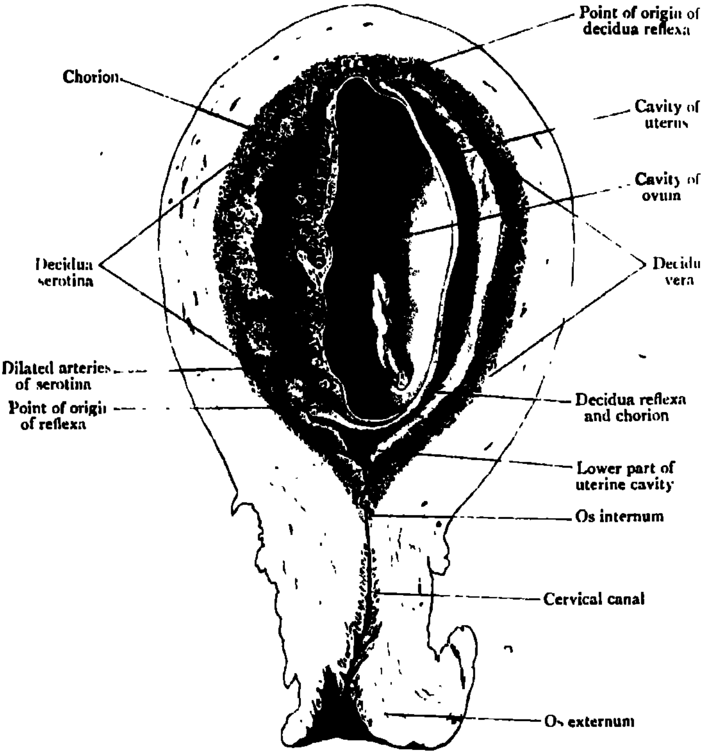

Point of origin of decidua reflexa
Chorion
Cavity of uterus
Cavity of ovum
Decidua serotina
Decidua vera
Dilated arteries of serotina
Point of origin of reflexa
Decidua reflexa and chorion
Lower part of uterine cavity
Os internum
Cervical canal
Os externum

FIG. 64.—UTERUS WITH OVUM AT THE THIRD MONTH OF PREGNANCY. SAGITTAL SECTION. (Bumm.)

The decidua receives different names according to its relation to the ovum. The latter, after its expulsion from the Graafian follicle, is received upon the ovarian fimbria, and is wafted by the cilia of the cells covering the fimbria, into the Fallopian tube.

Having traversed the Fallopian canal, it reaches the uterus and becomes embedded in the softened and hypertrophied mucous lining, to the whole of which the term decidua vera is applied. The latter becomes raised up all around the ovum, and gradually grows over it so as to separate it from the general cavity of the uterus. That part of the decidua vera with which the ovum first comes in contact is later called the decidua serotina, in consequence of the further changes which take place in it, and which result ultimately in the formation of the placenta. The part which becomes reflected over the ovum is called the decidua reflexa, and, as already stated, it separates the ovum from the general cavity of the uterus, which is lined by decidua vera. In each of these portions, important changes occur at the onset of pregnancy, and these must now be studied.

Decidua Vera.—From the commencement of pregnancy, a rapid hypertrophic change supervenes in the mucous lining of the entire uterus, and the former continues to increase till at the fifth month it has attained a depth of nearly half a centimetre, or about ten times its original thickness. The uterine glands, which are at first simple tubes of nearly equal calibre throughout, become greatly elongated and enormously dilated in their deeper parts, and numerous lateral outgrowths spring from them. Their mouths become dilated into funnel-shaped openings, which appear as little pits on the surface, but no increase in size of the lumen is found in the glands in the part immediately subjacent to the surface, and they here appear as elongated parallel tubes, separated by a considerable amount of intervening tissue, in which numbers of large cells, called decidual cells, are found. These cells vary in form and possess large rounded nuclei. They are connected to one another by cellular processes, and occasionally become aggregated into large clumps. Some difference of opinion exists regarding their origin, and by many writers they are stated to be migrated leucocytes. According to Webster,* however, there is no doubt that they are derived by hypertrophy and proliferation from the normally existing cells of the part. Their presence, together with the increased connective tissue, causes the more superficial portion of the decidua to be firm and compact as compared with the deeper part, and it is consequently termed the stratum compactum.

In the deeper parts, where the glands undergo great dilatation, there is but little hyperplasia of the supporting tissue, and, when sections are made through it, it is seen that the glands no longer pursue a straight course, but have become flattened out, often with their long axis parallel to the surface, and present the appearance of a network of intercommunicating spaces separated by intervening septa. To this part, the term stratum spongiosum is applied, and it is through it that the decidua becomes separated during labour. The blind extremities of the glands, which are in contact with the muscular coat of the uterus, and which do not share in the general dilatation, are left behind and prob-

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* Webster, J. C., 'Human Placentation,' 1901, p 18

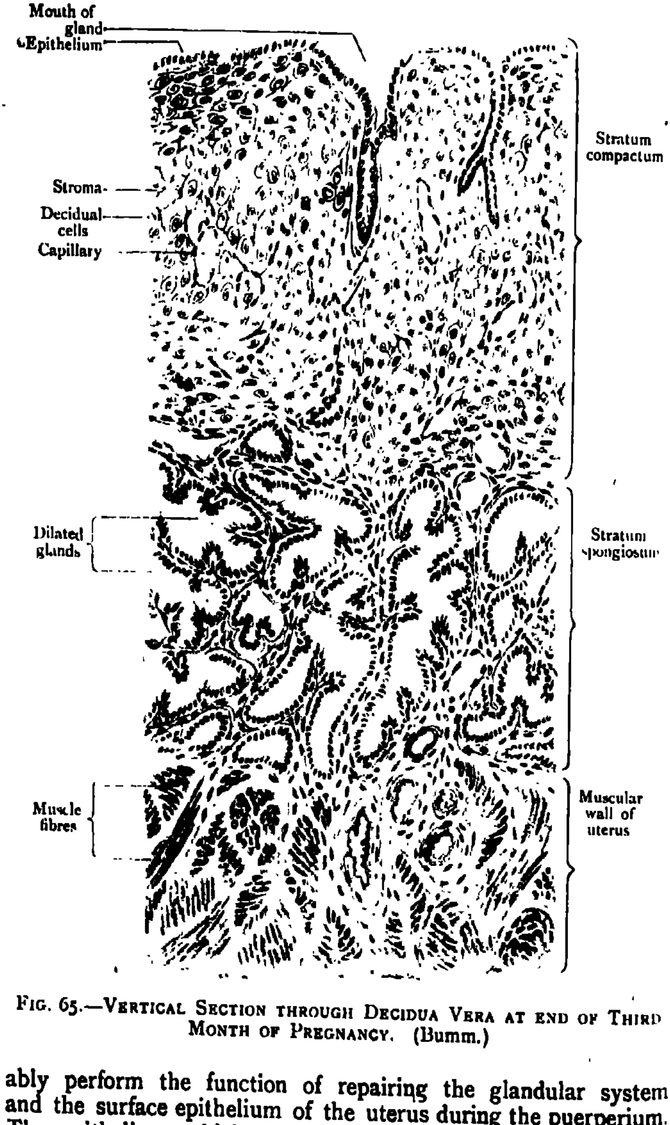

FIG. 65.—VERTICAL SECTION THROUGH DECIDUA VERA AT END OF THIRD MONTH OF PREGNANCY. (Bumm.)

ably perform the function of repairing the glandular system and the surface epithelium of the uterus during the puerperium. The epithelium which lines the free surface of the mucous membrane, as well as that contained within the glands, early loses its ciliæ and becomes of a low columnar or cubical type. Later, it is found in many places to have disappeared or to persist as an extremely flattened layer, especially in the spaces of the stratum spongiosum.

The vessels of the stratum compactum show in many places an enormous capillary dilatation, small sinuses being formed which communicate directly with the veins and arteries passing through the outer layer. These sinuses are lined by a single endothelial layer. No special vascular change occurs elsewhere.

From the end of the fifth month onwards retrogressive changes commence in the decidua vera, and at the end of pregnancy it has again been reduced to a thickness of only two millimetres. The compact layer almost entirely disappears, becoming flattened out into a number of thin lamellæ of fibrous tissue in which no glandular structure can be recognised. The mouths of the glands also cease to be visible, but in the stratum spongiosum the dilated spaces still appear as fissures in the mucous membrane separated by strands of connective tissue, which have in many places broken down. The capillary sinuses of the compact layer still persist, but have become smaller. This general atrophy of the decidua vera in the later months of pregnancy must be attributed to the effects of the pressure of the growing ovum upon it.

Decidua Reflexa.—The decidua reflexa has been stated to be formed by a reflection of the mucous membrane across the ovum in such a manner as to completely encapsule it. That this is the case is proved by the examination of some early specimens, especially one recorded by Peters,* in which the ovum was only about six days old, and in which the process of infolding was not complete, and also by the fact that the decidua reflexa closely corresponds in structure with the decidua vera. The exact mode of reflection of the decidua is, however, doubtful, and it now appears probable that the infolding process is more the result of the ovum sinking into the decidua than of the decidua growing over the ovum. 'In the early months of pregnancy, glands are seen opening on both surfaces of the decidua reflexa, and a differentiation into stratum compactum and stratum spongiosum is well seen in those parts, which lie closest to the uterine wall. Decidual cells and capillary sinuses are also present. As the ovum enlarges, the true cavity of the uterus becomes diminished in capacity, and, except in the region of the cervix, has entirely disappeared after the third month, owing to the decidua reflexa coming into close contact with the decidua vera.' Degenerative changes then occur in the former, as the result of the pressure to which it is subjected, and it finally becomes reduced to a very thin membrane, which is even in some places deficient, so that the amnion and chorion come directly into relation with the decidua vera.

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* Peters, 'Ueber d. Einbettung d. menschl. Eies.,' Wien, 1899.

Decidua Serotina.—In the decidua serotina, the early changes lead, as elsewhere, to a separation into a stratum compactum and a stratum spongiosum. The glands in the latter become completely flattened out, and their epithelium disappears, except in a narrow basal zone attached to the muscular coat. In the stratum compactum, the glands entirely disappear at an early date, and after the sixth week none of the covering layer of epithelial cells can be demonstrated. It is through the zone of flattened out gland spaces that separation of the placenta takes place, while in connection with the more superficial parts very important changes occur, which will be discussed immediately in connection with the placenta, of which they form a part.

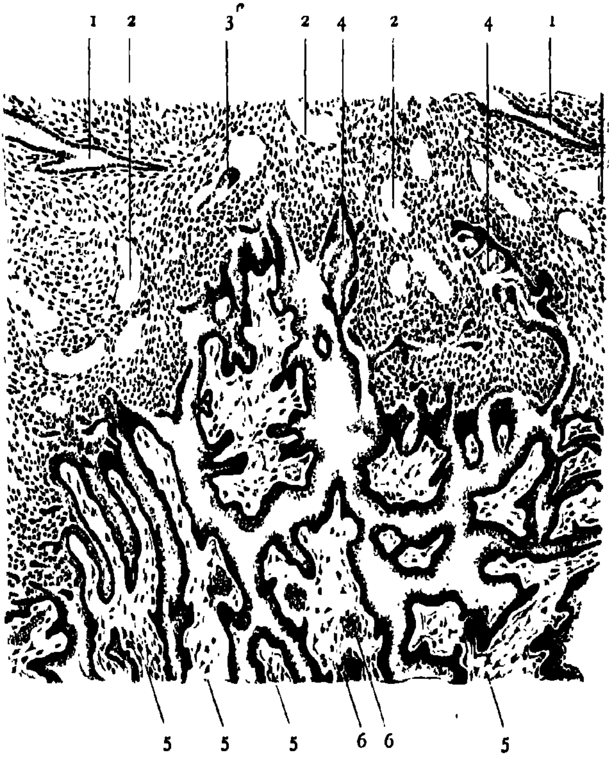

Fig. 66.—Section showing Chorionic Villi extending into Decidua Serotina.

1, Gland; 2, capillaries of serotina; 3, syncytial processes in a maternal capillary; 4, syncytium; 5, chorionic villi with syncytium; 6, capillaries of villi. (Bumm.)

THE PLACENTA

The placenta at term is an excessively vascular structure of an irregular oval or discoid shape, composed partly of altered uterine mucous membrane (placenta uterina) and partly of highly developed chorionic villi (placenta fœtalis). Its diameter is from six to eight inches. It is usually thickest in the centre, where it attains a depth of a little over one inch, and thins out towards the edges, to which are attached the amnion and chorion, together with the remains of the uterine decidua. In some cases, however, it is of almost equal thickness throughout its whole extent. In weight it varies from one to one and a half pounds. It is most frequently situated in the region of the fundus of the uterus, usually to one side of the middle line, and occasionally covers over the ostium internum of one of the Fallopian tubes. The surface, which is turned towards the fœtus, is smooth and covered by amnion, under which can be seen ramifying large branches of the umbilical arteries and vein, of which the former lie superficially and cover over the latter. The uterine surface, on the contrary, is irregular, and presents a number of lobular projections or cotyledons separated from one another by shallow intervening furrows. The cotyledons correspond to groups of chorionic villi, as will be more fully appreciated when the method of development and the microscopical structure of the organ have been studied.

The chorionic membrane in the early stages of its existence is covered almost uniformly with small villi, which project into pits in the decidua serotina and decidua reflexa between the openings of the uterine glands. At first, there is no mesoblast within the villi. They are, in fact, formed entirely by the proliferation of the cells which form the outer epiblastic portion of the chorion. To these cells Hubrecht has given the name ‘trophoblast,’ [1] since they appear to exert upon the decidua some absorptive influence, which enables them to form the depressions in which they are placed. As soon as the allantois with its arteries has reached the deep surface of the chorion, a branch of the umbilical artery is given to each villus, in which it breaks up into capillaries. From the villi, the blood is again collected by small veins, which are tributary to the umbilical vein. As early as the third week it is noticed that the villi in relation to the decidua serotina are larger than those which cover the remainder of the chorion. The latter at first are related to the reflexa in a manner similar to what is found in the serotina, and are bathed with maternal blood contained in the dilated capillaries of the stratum compactum; but, after the sixth week, they show signs of degeneration, and at a later date are found to be almost entirely atrophied, while the chorion has become directly united to the thinned out reflexa.

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[1] Hubrecht, ‘Die Phylogenese d. Amnions und d. Bedeutung d. Trophoblasts.’

In the placental region, on the contrary, the villi become much enlarged, and from all sides of the main stem small vascularized branches bud off, so that very complex villous processes are produced. The main stem is embedded in the uterine mucous membrane, and so also are some of the lateral offshoots, but many of the latter hang free in a space intervening between themselves and the decidua. This space is supposed to contain maternal blood, and to form a series of intercommunicating blood sinuses. Each villus is now composed of a central stalk containing bloodvessels embedded in a gelatinous connective tissue derived from the chorionic mesoblast, and is covered by a double layer of epithelial cells, both of which are derived from the original mesoblast. The innermost of these two layers, that which lies next the mesoblastic stalk (endochorion), is composed of a single layer of clearly differentiated cells, round or cubical in form, and containing well-developed nuclei. It is known as Langhans' layer, after the name of the authority who first described it. The cells which form it do not stain well with the ordinary aniline dyes. In the outer layer no division into individual cells can be made out, because the cells have run together into plasmodial masses of granular protoplasm, which contain, arranged irregularly within them, numerous deeply-staining nuclei. This layer was originally supposed to be maternal in origin, and to represent the epithelial covering of the uterine mucous membrane, but it is now definitely proved that such a covering entirely disappears at a very early date, and most authorities are agreed that the origin of the syncytium, as the layer is called on account of its characteristics, is as above stated. It is the syncytium which forms the primitive villi, and to which the term 'trophoblast' is given. As the cells which form it proliferate, the villi project into the decidua, and, causing an absorption of that structure, they come in contact with the blood sinuses of the stratum compactum. Vacuolation followed by absorption then occurs in the cells of the trophoblast, so as to form spaces between the different branches of the villi, and it is these spaces which become filled up with blood and constitute an extension of the maternal sinuses, while at the same time the deeper layers of the trophoblast assume syncytial characters.

The exact mode in which these spaces become dilated with maternal blood is still a matter of doubt. Many authorities believe that the trophoblast is capable of absorbing the endothelial walls of the capillaries as well as the tissue of the uterine decidua, and that blood becomes effused into the spaces by the direct rupture of the capillary walls. It appears, however, more probable that the capillary sinuses themselves dilate *pari passu* with the disappearance of the trophoblast, and thus come to occupy the intervillous spaces. If this is the case, a layer of vascular endothelium lining the capillary walls should be found on the surface of the syncytium separating the fœtal tissues from the blood of the mother, and although this has not been conclusively demonstrated, there is some evidence of its existence at an early date. Such a layer of cells from its extreme tenuity may readily become atrophied later on as a result of the pressure to which it, in common with the other parts of the uterine mucous

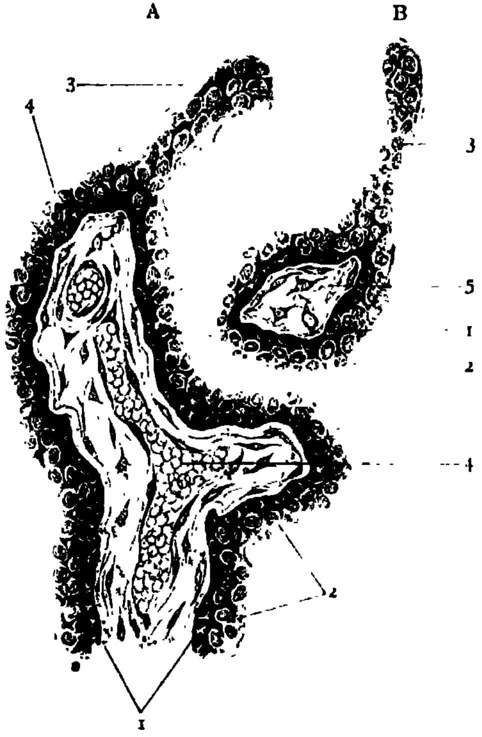

Fig. 67.—Chorionic Villi of a Five Weeks'-Old Ovum

A, Longitudinal section; B, cross-section. 1, Langhans' layer; 2, syncytium; 3, syncytial outgrowth; 4, fœtal capillary; 5, stroma of villus. (Bumm.)

membrane, becomes subjected from the growth of the fœtus and the intermittent contractions of the uterus itself. It is also quite credible that, atypically, rupture of capillaries may occur in consequence of the extremely rapid dilatation which they undergo, and that in some places a genuine extravasation of blood may take place.

If the deeper parts of the decidua serotina are studied subsequent to the formation of the sinuses, numerous spirally twisted arteries are found traversing the stratum spongiosum and opening into the blood spaces. Intervening between these, as they lie in the stratum compactum, there are a large number of so-called giant cells. It is probable that these giant cells are really the extremities of fœtal villi cut transversely. They are specially abundant in the later months of pregnancy, and are supposed to obstruct the flow of blood in the smaller venules just before labour. As the arteries pass through the stratum compactum just before they communicate with the blood sinuses, they lose their distinctive arterial characters and come to resemble veins. The blood which flows in through these efferent channels traverses the space between the chorion and decidua, flowing in a slow continuous stream which bathes the chorionic villi, and emerges by small afferent vessels which open into veins contained in the stratum spongiosum. Around the circumference of the placenta, the sinuses communicate freely with one another by means of a circumferential marginal sinus. All of the spaces, including this marginal sinus, can be injected through the maternal bloodvessels, but there is in no place any direct communication between the fœtal and maternal blood systems. The fœtal blood is separated from that of the mother by (1) the syncytium, (2) Langhans' layer, (3) chorionic connective tissue, (4) endothelium of fœtal capillaries.

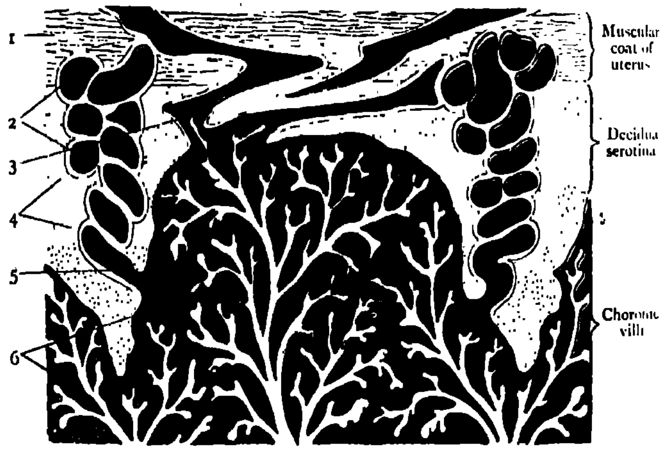

Fig. 68.—Diagrammatic Representation of Portion of Placenta (Bumm.)

1, Muscular coat of uterus; 2, maternal arteries; 3, maternal veins. 4, decidua; 5, mouth of artery; 6, inter-villous space.

In the foregoing description of the placental structure it has been stated that in the latter half of pregnancy the chorionic villi float in the maternal blood, and are in direct contact with it, without the interposition of any decidual tissue, and this is the generally received view. It is, however, only right to state that some writers adhere to the opinion that the spiral arteries really terminate in dilated capillaries in the stratum spongiosum, and that intervening between them and the villi, a layer of decidual tissue exists which is credited with a glandular function. This layer is, in fact, supposed to exercise a selective absorptive power upon the constituents of the maternal blood, and to secrete, in the form of lymph, the materials which it has taken up around the villi, into whose bloodvessels it is absorbed. Whatever is the exact mode, however, in which nutritive material is transferred from the mother to the ovum, there is no doubt about the important part which the placenta, as a whole, plays in the process, and about its power of selecting one substance and rejecting another, according to the requirements of the fœtus at different periods.

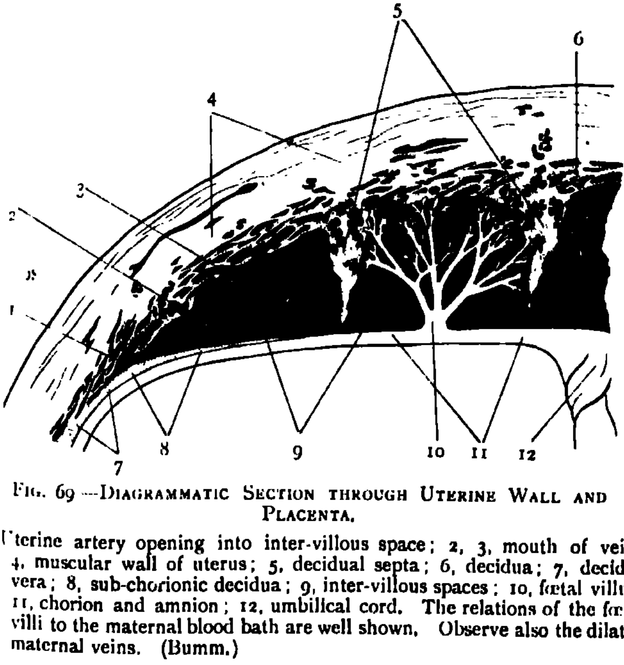

FIG. 69—DIAGRAMMATIC SECTION THROUGH UTERINE WALL AND PLACENTA.

1, Uterine artery opening into inter-villous space; 2, 3, mouth of vein; 4, muscular wall of uterus; 5, decidual septa; 6, decidua; 7, decidua vera; 8, sub-chorionic decidua; 9, inter-villous spaces; 10, fœtal villus; 11, chorion and amnion; 12, umbilical cord. The relations of the fœtal villi to the maternal blood bath are well shown. Observe also the dilated maternal veins. (Bumm.)

Functions of the Placenta.—The placenta acts as the organ of respiration, nutrition, and excretion to the growing fœtus. Venous blood is conveyed to the chorionic villi by means of the umbilical arteries, and then absorbs oxygen from the maternal blood, while at the same time, either by a process of diffusion or by means of the selective activity of the cells covering the villus, carbon dioxide gas is conveyed to the maternal circulation. The actual amount of gaseous exchange is not very great, and, consequently, very little difference of colour can be noted between the blood in the umbilical vein and arteries, but oxyhæmoglobin is more easily detected by the spectroscope in the blood in the former of these vessels. That the placenta does carry out the function of oxygenation is proved, if in no other way, by the fact that if the cord be compressed during labour and the circulation in its vessels interrupted, as frequently occurs in breech presentations, attempts at respiration by the lungs are almost immediately made, due to stimulation of the respiratory centre in the medulla by the increasing venosity of the blood. A similar stimulus aids in bringing about the first respiration after birth in normal cases, even before the cord is cut, owing to the arrest of the maternal circulation in the placenta brought about by the uterine contractions. Not only can oxygen and carbon dioxide gas pass through the placenta, but also such substances as alcohol—as has been proved by experiments on animals—and chloroform. In some cases in which the latter is used as an anæsthetic during labour,

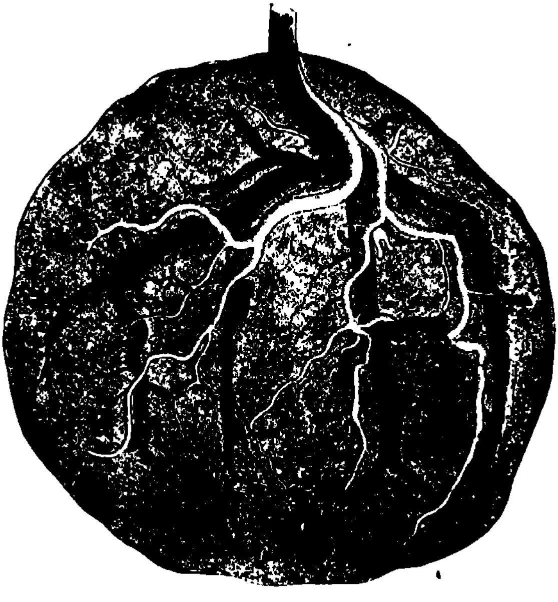

FIG. 70.—PLACENTA AT FULL TERM, SHOWING SUPERFICIAL DISTRIBUTION OF BLOODVESSELS. (Minot.)

the smell of chloroform can be detected in the breath of the child for some hours after delivery.

In addition to its respiratory function, the placenta also permits the passage of a large amount of the waste materials derived from the proteid metabolism of the fœtus, and of which urea probably forms the greatest part, and also enables nutritive material to pass from the maternal blood to that of the fœtus. In this latter function it exhibits considerable power of selection, and it is now almost certain that the quantity and quality of the different materials absorbed vary in accordance with the requirements of the fœtus at different periods. Thus, during the later months of pregnancy a considerable storage of iron accumulates within the fœtus, and serves as a reserve for the future formation of hæmoglobin. During the same period a relatively large amount of potassium and calcium salts pass from the mother to the fœtus, as has been proved by analyses of fœtal tissues at different months. The potassium and calcium salts are evidently required for the great muscular and skeletal development which is going on during the later months of pregnancy. That the passage of materials does not merely depend upon their solubility, is shown by the fact that there is a larger percentage of glucose in the blood of the mother than in that of the child.

Analysis of the placenta shows that four-fifths of it is composed of water, and that it contains, in addition to the salts and albuminous materials within it, a comparatively large amount of glycogen. This latter fact has caused a glycogenic function to be attributed to it.

In addition to the above functions, the placenta must in some ways act as a protection to the fœtus, by arresting the passage of microbic and toxic substances. The protective power is not highly developed, however, and may be easily broken down, as is shown by the transmission of the infective agent of syphilis and of the germs of the various zymotic diseases from which the mother may suffer during pregnancy. Possibly such germs are carried across by leucocytes, which are supposed to have the power of migrating from the maternal blood to that of the fœtus, on account of their being found in greater numbers in the blood of the umbilical vein than in that of the arteries.

Recently, it has been stated by Bouchard that the placenta furnishes an internal secretion formed within the cells of the syncytium, and which has a specific galactagogue power. He has isolated a substance which he terms chorionine, from the juice of fresh placentæ, and states that he has observed favourable results from its administration in patients who were suffering from defective mammary secretion. His results are not improbable, but require confirmation.

THE UMBILICAL CORD

The umbilical cord constitutes the bond of union between the fœtus and the placenta, extending from the umbilicus of the former to the centre of the amniotic surface of the latter. Its length is usually about twenty inches, but it varies within wide limits, having been found as short as five inches and as long as five feet. In cases of congenital absence of the anterior abdominal wall indeed, due to defective closing in of the primitive limiting sulci, the fœtus may be directly united to the placenta and the cord completely absent. In the early stages of gestation, the cord is short, and the fœtus then appears to be suspended by it within the amniotic fluid, but as the amnion enlarges the cord becomes longer and lies in folds within the amniotic cavity.

The cord usually presents a series of spiral twists from left to right, which have been attributed by some authors to rotation of the fœtus *in utero*. Such an explanation is, however, inadequate, as it fails to show why rotation should always take place in the same direction. Apart from undoubted cases of axial rotation, which not infrequently occur, and usually cause the death of the fœtus by obliteration of the lumen of the umbilical vessels, it is probable that the twist is only a surface marking produced by the course of the arteries within the cord. Small hernia-like projections are also very frequently seen on the surface of the cord, and are caused either by hypertrophy of the connective tissue in places, or by local dilatations of the vein. Occasionally, even true knots are found. When these are formed during expulsion of the fœtus no diminution of the calibre of the cord is found at the place where they exist, but if they occur at an earlier date they usually give rise to marked indentations of the cord, the result of pressure atrophy of its connective tissue. In some

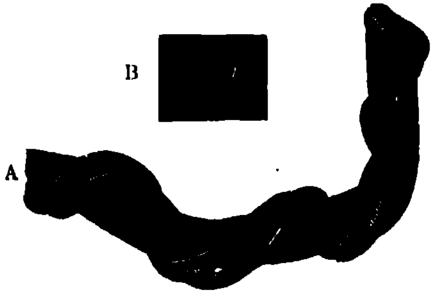

FIG. 71.—UMBILICAL CORD, SHOWING VESSELS

A, Umbilical arteries coiling spirally around the umbilical vein; B, section through cord, showing the arteries at the sides of the vein and a valvular fold in the vein. (Tarnier and Chantreuil.)

cases, they may, indeed, become so tight as to arrest circulation within the umbilical vessels and to bring about the death of the fœtus, while if any part of the fœtus lies within the knot strangulation of it may result.

The cord is surrounded superficially by a covering of amnion, which blends in the region of the umbilicus with the skin of the abdominal wall, and on reaching the placenta spreads out on its deep surface over the umbilical bloodvessels. It is by the gradual deepening of the limiting sulci and consequent closing in of the line of reflection of the amnion on the ventral surface of the embryo that the various structures which form the cord are brought together. The constituents are the two umbilical arteries, the umbilical vein, and the remnants of the vitelline and allantoic ducts, all of which are bound together by a gelatinous connective tissue known as the Whartonian jelly, and which lies enclosed within the amniotic sheath.

The umbilical arteries arise in the pelvis of the fœtus from the trunks of the internal iliac arteries, and passing upwards on the posterior aspect of the anterior abdominal wall, enter the cord at the umbilicus. They present within the cord a spiral twist from left to right, corresponding to that which has been already noticed in connection with the cord itself, and lie superficially surrounding the vein. Their twisted course probably serves to check the pulsation of the blood-stream before they reach the villi. Just before reaching the placenta, the arteries are frequently connected by a transverse communicating branch. On the placenta itself, they break up into numerous branches which lie superficial to the veins and are distributed freely to the chorionic villi. The arteries have a thick muscular wall and a well-marked power of contraction.

The umbilical vein is single. At first, two veins exist, but at a very early date in pregnancy the two become fused within the cord into a single trunk, which enters the abdomen of the fœtus and passes upwards in the falciform ligament of the liver. It occupies a central position within the cord and is devoid of complete valves.

In the earlier months of pregnancy, the remains of the vitelline and allantoic ducts can usually be demonstrated within the cord as columns of epithelial cells, and accompanying the former may be seen small vitelline bloodvessels. At term, however, these structures have almost entirely disappeared, though when sections are made traces of their presence may be found here and there in the form of small islets of epithelial cells. Occasionally, even the umbilical vesicle or yolk sac may be found as a minute sac lying between the amnion and the chorion near the margin of the placenta.

The jelly of Wharton, which serves to bind together the foregoing structures, is chiefly composed of stellate cells which are covered with branching and anastomosing processes. Connective-tissue strands and elastic fibres can also be demonstrated within it. The amnion is closely adherent to its substance.

THE LIQUOR AMNII

The liquor amnii is alkaline in reaction and has a specific gravity of from 1007 to 1011. In quantity, it averages about three pints, but wide variations exist. It is at first clear and transparent, but towards the end of pregnancy it becomes darker in colour and somewhat turbid. On analysis, it is found to contain about 97 per cent. of water, together with traces of albumin, grape-sugar, urea, and various salts of potassium, sodium, calcium, magnesium, and ammonium. Traces of albumoses and peptones have also been detected. Floating within it, are found lanugo hairs and desquamated epithelium from the fœtal epidermis.

The exact origin of the liquor amnii is still a matter of doubt. At different times it has been supposed to be derived from the mother alone and from the fœtus alone. Probably, however, it is really derived from both maternal and fœtal sources, though without doubt the greater part of it is formed by transudation from the vascular system of the mother. Drugs given to the mother (*e.g.*, potassium iodide) can often be detected subsequently in the fluid. The presence of urea seems to point to its receiving the secretion of the fœtal kidneys; but that this is an accidental rather than an essential occurrence as far as the fluid itself is concerned is proved by the fact that the liquor amnii is not necessarily, or indeed often, deficient in cases in which the ureters or urethra are imperforate. Those authorities who believe that the fluid is entirely fœtal in origin hold that it is exuded early in pregnancy from a system of capillary vessels on the fœtal side of the placenta—the vasa propria of Jungbluth, and point out that the persistence of these capillaries is associated with hydramnios. Their statements, however, lack sufficient evidence, though it is extremely probable that a small amount of the fluid is derived from this capillary plexus, and also from the vessels in the umbilical cord itself.

The functions of the amniotic fluid are important both during gestation and during labour. Being a bad conductor of heat, it serves during pregnancy to maintain an equable temperature around the fœtus, and at the same time its presence diminishes the transmission of shocks and allows room for the fœtal movements. Possibly, it exerts a slight nutritive function, and many believe that it is swallowed by the fœtus during the later months of pregnancy in large quantities. During labour, it acts as a fluid dilator of the cervix, and prevents the contracting uterus from exerting injurious pressure upon the child.

CHAPTER IV

THE FŒTUS

e Physiology of the Fœtus; The Circulatory System; The Digestive System; The Nervous System--The Characteristics of the Fœtus at the Different Months—The Full-Term Fœtus; General Characteristics, Height and Length; The Fœtal Skull, General Characteristics, Sutures, Fontanelles, Diameters, Circumferences, Regions; The Fœtal Trunk The Relations of the Fœtus to the Uterus: Attitude; Lie; Presentation; Position

THE PHYSIOLOGY OF THE FŒTUS

The Circulatory System.—During its development, the fœtus passes through at least three distinct stages as regards its method of obtaining nutrition: (*a*) A primary stage, during which it directly absorbs nourishment from the albuminous envelope surrounding it, and, according to some authorities, from the uterine wall by means of primitive villi formed upon the zona pellucida; (*b*) a secondary stage, in which the vitelline circulation is established and the contents of the yolk sac are thereby utilized; (*c*) a tertiary stage, subsequent to the formation of the placenta, and during which, that structure enables the fœtus to derive its food-supply from the maternal blood.

In order that the nourishment obtained in this last method may be expended to the greatest advantage of the fœtus, several important structural differences are present in its vascular system, as compared with those found in extra-uterine life. The course of the blood, as determined by these structures, prevents any definite separation into systemic and pulmonary systems, and leads to a considerable mixture of venous and arterial blood. These modifications may be dealt with seriatim:—

The foramen ovale is a wide aperture, which exists in the interauricular septum, and brings the two auricles into communication with one another. It is somewhat valvular in character, and permits blood to flow from the right to the left side, but not in the opposite direction. Towards full term, it diminishes somewhat in size. Leading down from its anterior margin to the inferior vena cava is a small fold of endocardium, called the

Eustachian valve, which directs the blood entering the auricle through the inferior vena cava towards the foramen.

(4) The ductus arteriosus is a wide, communicating channel which exists between the pulmonary artery and the aorta, being

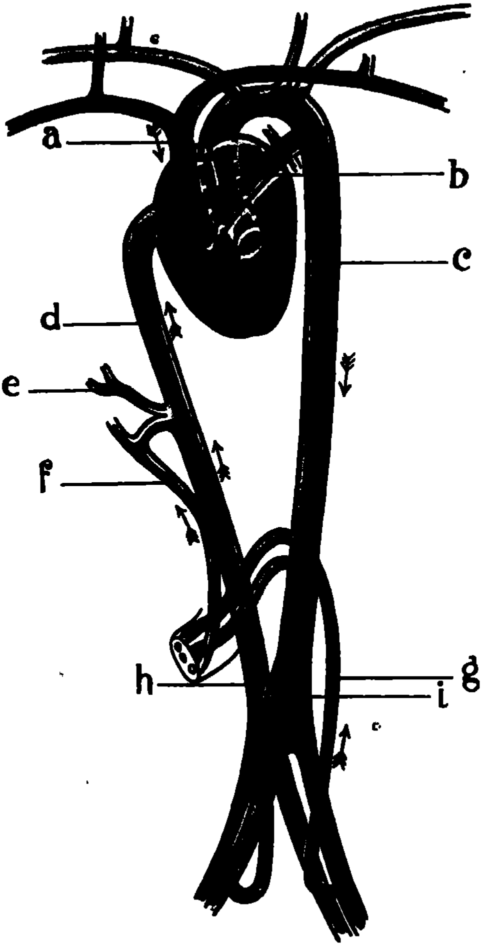

FIG. 72.—DIAGRAMMATIC REPRESENTATION OF FŒTAL CIRCULATION.

a, Superior vena cava; *b*, pulmonary artery; *c*, descending aorta; *d*, inferior vena cava; *e*, hepatic vein; *f*, umbilical vein; *g*, hypogastric artery; *h*, inferior vena cava; *i*, descending aorta.

connected with the former just at its point of bifurcation, and with the concavity of the arch of the latter. It enables the blood in the pulmonary artery to enter the arch just below the point of origin of the left subclavian artery.

The hypogastric arteries arise from the common iliac arteries, and pass forwards along the side of the bladder to the posterior aspect of the anterior abdominal wall, along which they ascend till they reach the umbilicus. Their extra-fœtal portion within the umbilical cord has been already described.

The umbilical vein enters the abdomen at the umbilicus, and passes along the under surface of the liver within the fold of the falciform ligament of the latter, to the portal vein. A continuation of it then passes from the opposite side of the portal vein to the inferior vena cava, and is known as the ductus venosus.

In the full-term fœtus, the course of the blood is as follows:—Arterial blood from the placenta flows along the umbilical vein to its junction with the portal vein, where the current divides into two channels, a small part passing with the blood from the intestinal tract through the liver by means of the portal vein, and flowing ultimately through the hepatic veins into the inferior vena cava at the upper surface of that organ. The remainder flows through the ductus venosus directly into the inferior vena cava. At first, the entire current of blood flows into the portal vein, but as the umbilical vein increases in size, in correspondence with the increasing amount of blood flowing through it, the portal system becomes insufficient for its transmission, and the ductus venosus becomes developed. This short circuiting of the current is obviously of advantage, by enabling the greater amount of the arterial blood to pass directly to the heart, where it can be dis-

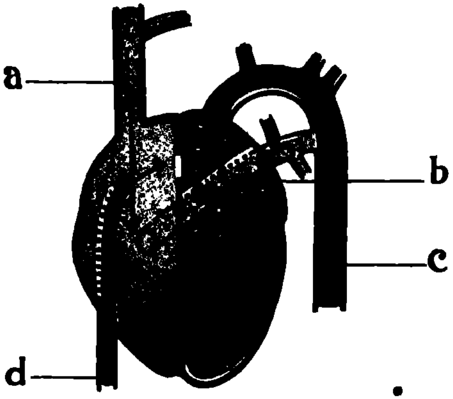

FIG. 73.—DIAGRAMMATIC REPRESENTATION OF FŒTAL HEART

a, Superior vena cava; *b*, pulmonary artery; *c*, descending aorta; *d*, inferior vena cava. The arrow leading from the orifice of the inferior vena cava is directed towards the foramen ovale.

tributed to the cephalic region of the embryo, without being previously deoxygenated in the liver. The entire amount of blood which flows into the right auricle through the inferior vena cava, representing the blood from the placenta, that of the portal system, and the blood from the lower limbs, is directed by means of the Eustachian valve and the tubercle of Lower through the foramen ovale into the left auricle, from whence it is driven into the left ventricle. From this latter chamber it is pumped into the aorta, and is almost entirely distributed by means of the carotid and subclavian arteries to the head and upper limbs, so that these regions of the body obtain the purest blood that is driven from the heart.

The blood, returning from the upper parts of the body through the innominate veins, enters the right auricle by the superior vena cava, and passes on into the right ventricle, whence it is pumped into the pulmonary artery. A small part of this current then flows through the right and left pulmonary arteries into the lungs, and returns to the left auricle through the pulmonary veins; but, by far the greater proportion is directed through the ductus arteriosus into the aorta, below the level at which the trunks for the upper part of the body arise, and consequently flows downwards in the descending aorta to supply the abdominal viscera and the lower limbs. In addition to this distribution, a considerable proportion of the current flows through the hypogastric arteries to the placenta.

In association with the fact that the head receives the best oxygenated blood, it is found at birth to be developed much more in proportion than the other parts of the body. The liver also receives some arterial blood directly from the placenta, and is correspondingly large.

As the fœtus approaches full term, slight narrowing of the foramen ovale and of the ductus arteriosus takes place, preparatory to the establishment of two distinct circuits, pulmonary and systemic, and immediately after delivery very important changes occur. The cessation of the placental circulation diminishes the amount of blood which reaches the right auricle, and consequently causes the pressure in that chamber to fall relatively to that in the left auricle. Moreover, the pressure in the latter chamber is itself greatly increased in consequence of the expansion of the capillaries in the lungs, which takes place coincident with the establishment of pulmonary respiration, and enables a greater quantity of blood to flow into the auricle. The result is that the flow of blood through the foramen ovale is stopped by the closure of the valve which guards it, and later on the foramen becomes entirely occluded by the formation of adhesions. At the same time, the suction of the blood in the pulmonary arteries into the lungs, together with the high aortic blood-pressure, prevents the passage of any blood through the ductus arteriosus. The walls of the duct in consequence come in contact with one another, and in a few days the duct is completely occluded without the formation of thrombus. It closes first in the centre, and remains pervious longer at the aortic than at the pulmonary extremity in consequence of the higher pressure at the aortic end.

The hypogastric arteries and the umbilical vein, with its continuation the ductus venosus, also become obliterated soon after birth. The arteries are usually closed by the second day, the process being partly effected by the formation of thrombi within them. Great thickening of the fibrous tissue of their walls also takes place, and ultimately reduces them to the condition of fibrous cords. The vein remains patent till a slightly later date, but is usually closed by the seventh or eighth day.

The Digestive System.—Very little is definitely known concerning the activity of the various glands connected with the alimentary canal in the fœtus. A few observations have been made which show that the salivary and gastric ferments are present at birth, and according to some at a much earlier period. Trypsin also is stated to be present in the pancreatic secretion in the second half of pregnancy, and the fat-splitting ferment is in most cases present at birth. The amylopsin of the pancreatic secretion does not, however, appear till some time after birth.

The large size of the fœtal liver has caused it to be credited with important functions. It assumes its characteristic structure at about the fifth month, and at the same time commences to secrete a greenish-coloured bile. The latter collects in the large intestine and forms the greater part of the meconium, in which bile-acids and bile-pigments can be shown to exist. It also collects in the gall-bladder, which is sometimes found fully distended in full-term fœtuses. Before the secretion of bile no meconium is found in the intestines, but after the fifth month it collects in large quantities. Analysis shows that it contains, in addition to the bile-pigments and salts, a considerable amount of mucin, and secretions from the various intestinal glands, more especially that of the pancreas. The presence of lanugo, vernix caseosa and epidermal cells within it, confirms the opinion that the liquor amnii is swallowed at intervals by the fœtus. In cases of occlusion of the bile-ducts the meconium is of a brownish colour. In addition to its function in secreting bile, it is generally supposed that the glycogenic function of the liver is early established, and that its large size is correlated with the presence of large amounts of sugar in the tissues of the fœtus. Some glycogen can be detected in its substance at birth.

The principal waste substances which result from the nitrogenous metabolism of the fœtus are excreted by means of the placenta into the maternal circulation, but a small amount of urea and uric acid is also passed with the secretions of the kidney into the bladder, and is thence probably passed at intervals into the amniotic fluid. That the bladder is frequently full during intra-uterine life is proved by the familiar fact of the emptying of that viscus which so often takes place immediately after birth, but, that any important excretory function is performed by the kidneys before birth has not been proved.

3 **The Nervous System.**—The various parts of the spinal cord and brain are only gradually developed, and at birth the cortical cells are still rudimentary, so that it is probable that till some time after birth the child is neither capable of receiving painful sensations nor of exerting true voluntary movement. Reflex movements, however, take place actively *in utero*, and can readily be excited by stimulation of the abdomen of the mother, and by various other means.

THE CHARACTERISTICS OF THE FŒTUS AT THE DIFFERENT MONTHS

First Month.—Among the earliest human ova which have been described are those obtained by Peters and Leopold.* The latter was supposed to be about ten days old, and the former still younger. Reichert has also described an ovum of about twelve days old. In none of these was any definite embryonic area visible, but Leopold's and Reichert's were covered with primitive villi, which in Reichert's specimen formed a definite equatorial zone around the greatest circumference of the vesicle. In Peters' specimen of six days, the commencement of the formation of villi could be detected. By the end of the second week, the embryonic area has appeared, and the embryo measures about one-twelfth of an inch, while the length of the ovum is nearly a quarter of an inch. By the end of the third week, the embryo has attained a length of one-sixth of an inch. The medullary canal is formed, and shows the differentiation into cerebral vesicles anteriorly, and also the rudiments of the visual and auditory structures. The visceral arches are present, and the stomatodæum is well defined, while small lateral projections represent the commencement of formation of the limbs. 5 The amnion is fully formed, and the vitelline duct is commencing to narrow. 7 The vitelline circulation is established, 8 and the allantois is in contact with

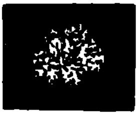

FIG. 74.—EARLY HUMAN OVUM—FROM FOURTEEN TO TWENTY-ONE DAYS OLD (NATURAL SIZE).

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* Leopold, 'Verhandl. d. deutsch. Gesell. f. Gyn.,' 1897. Reichert, 'Beschreibung einer frühzeit. menschl. Frucht.' Peters, "Ueber die Einbettung des menschl. Eies,' Wien, 1899.

the deep surface of the chorion. By the end of the fourth week, the embryo has again doubled in length. The various flexures of the neural canal have been formed, so that the fore-brain lies in front of the fore-gut, and the mid-brain forms a marked dorsal prominence. The heart, which appeared towards the end of the second week, has become larger, and the visceral arches and limbs are more pronounced. The mouth and anus are also formed. The amnion has not yet come into contact with the chorion.

Second Month.—During the second month, the embryo increases more gradually in size, and at the end of the eighth week measures about one and a quarter inches in length, and the whole ovum is about the size of a hen's egg. The umbilical vesicle has become small, and is suspended from the embryo by a narrow vitelline duct. The umbilical cord has increased in length, and the villi are becoming numerous in the region of the decidua serotina. The limbs, after the fifth week, show grooves which mark them out into three distinct segments, and rudiments of the fingers and toes have also appeared. Centres of ossification appear early in the sixth week in the lower jaw and in the clavicle. At the end of this month the nose begins to assume its normal shape.

Third Month.—At the end of the third month, the fœtus measures from three to three and a quarter inches in length, and weighs a little more than three ounces. The placenta has become formed, and the villi over the rest of the chorion have almost disappeared. The cord, which has become much elongated, has developed its spiral twist, and is inserted much nearer the tail than the head end of the embryo. Nails have appeared as thin scales on the fingers and toes, and centres of ossification are present in most of the bones. The head is separated from the trunk by means of the neck, and the mouth has become separated from the nasal cavities by the development of the palate. The folds which form the labia majora and scrotum are present, and the genital eminence is beginning to assume a characteristic male or female form.

Fourth Month.—At the end of the fourth month the fœtus attains a length of about five inches, one quarter of the entire length being formed by the head. The bones of the skull are ossifying, but are still separated by wide sutures and fontanelles. Fine downy hair has appeared on the scalp and over some other parts of the body. The mouth and nose have assumed their normal shape and the sex is now easily distinguishable. The Whartonian jelly has appeared around the vessels of the umbilical cord, and movements of the limbs have just commenced to take place.

Fifth Month.—The fœtus now measures about ten inches in length and weighs about a pound. A covering of fine hair (lanugo) covers the whole body, and the vernix caseosa has made its appearance. This latter is a greasy white material composed of sodden epidermis and sebum, and its presence prevents imbibition of the liquor amnii by the skin. The liver has assumed its characteristic histological character, and meconium is found in small amounts in the intestines. The head is still relatively large. The fœtal movements are now distinctly perceptible by the mother.

Sixth Month.—At the end of the sixth month, the length of the fœtus is about twelve inches and the weight about two pounds. The skin is still somewhat wrinkled, but a slight deposition of subcutaneous fat is present. The eyelids become separated and the eyebrows and eyelashes appear. The hair on the head is much longer than on the rest of the body.

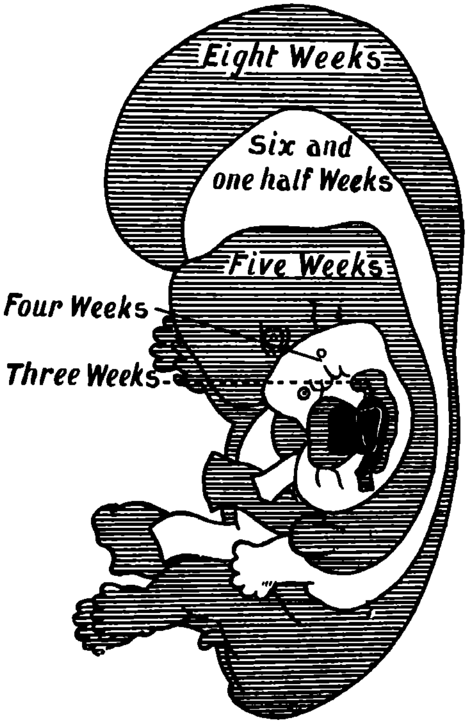

Fig. 75.—Diagrammatic Representation of Increase of Size of Fœtus from the Third to the Eighth Week.)

(Enlarged about three times. After Mall.)

Seventh Month.—The average length is now about fourteen inches, and the average weight about three pounds. In males, the testes have reached the inguinal canals. The subcutaneous fat has increased in amount, and the membrana pupillaris in front of the lens of the eye is very conspicuous. The fœtus is generally regarded as viable at the end of the seventh month, but many born alive at this period only survive for a few hours. Rarely, children born during the sixth month survive by the use of the incubator, but such survival must be regarded as exceptional.

Eighth Month.—The average length at the end of the eighth month is from sixteen to seventeen inches, and the weight is from four to four and a half pounds. The wrinkling of the skin is almost gone, and the lanugo is commencing to disappear. The pupillary membrane is also disappearing. In males, the testes are usually found in the scrotum. Children born at this period are less active than those born at full term, but can sometimes be reared if carefully tended.

Ninth Month.—In the ninth month, growth is less rapid, and the length may not increase more than an inch over that of the eighth month, *i.e.*, up to about 18 inches. The weight is from 4½ to 5½ lbs. Adipose tissue is now present in abundance, and an ossific centre usually appears at the end of the month in the epiphysis at the lower end of the femur.

Tenth Month.—The characteristics of the full-term fœtus are so important that they will be discussed at greater length in the following sections.

THE FULL-TERM FŒTUS

By the end of the tenth month, the marked redness of prematurity is toned down, and the skin of the fœtus is of a pale-red colour. The lanugo has almost disappeared, but traces may still be found upon the neck, shoulders, and back. The amount of vernix caseosa which covers the body is very variable. Sometimes it is almost, or entirely, absent; at other times, the infant is so covered with this substance that but little skin can be seen. The origin of vernix has been already mentioned, but we do not know of any attempts, other than those based on popular superstitions, to explain the marked variations which are met with in its amount. The finger-nails of the fœtus project well beyond the finger-tips, whilst the toe-nails have just reached the end of the bed of the nail. The hair is well grown, and is about an inch to an inch and a half in length. In male infants, the testicles have descended into the scrotum; in female infants, the labia majora project beyond and cover the labia minora. The insertion of the umbilical cord is from an inch to 1⅛ inches (2½ to 3 centimetres) below the middle point of the body (Winckel). If the infant is born alive and is healthy, it cries vigorously, and attempts to suck anything which is placed between its lips.

Weight and Length.—The average weight of the full-term fœtus is said to be between 6 lbs. 9·8 oz. and 7 lbs. 11·45 oz. (3,000 to 3,500 grammes), while the average length is twenty inches (48 to 54 centimetres). Considerable variations in the weight are commonly met with. Infants have been born at full term who did not exceed 4 lbs. 6·5 oz. (2,000 grammes), but in such cases there is usually some fœtal or maternal pathological condition which has interfered with development. On the other hand, cases have been recorded of infants who weighed 13 lbs. 3 oz. (Mme. Lachapelle), 15 lbs. 7 oz. (Neumann), 17 lbs. 10 oz. (A. Martin), and 19 lbs. 13 oz. (Cazeaux). However, any weight exceeding eleven pounds must be considered as very exceptional.

Various factors are known to influence the weight and length of a fœtus, and doubtless there are many more which have not been definitely ascertained. Ribemont-Dessaignes* has summarised the opinions of various authorities on the known factors as follows:—

(1) The fœtal weight increases with the age of the mother until she is twenty-nine, and then diminishes. The length of the fœtus increases with the age of the mother up to forty-four (Duncan).

(2) Repeated pregnancies tend to cause an increase in the weight and length of the fœtus (Hecker, Tarnier).

(3) Such increase in weight occurs with the greater regularity the longer are the intervals between each successive pregnancy (Wernich).

(4) In successive pregnancies, when a male infant follows a female there is more likely to be an increase in weight than when a female infant follows a male (Ribemont-Dessaignes). This is really only another way of saying that a male infant, as a rule, weighs more than a female.

(5) The earlier puberty occurs the better developed will be the infant.

The influence of sex and multiparity is further shown by the following table (Tarnier's):—

	PRIMIPARÆ.		MULTIPARÆ.	
	Male.	Female.	Male.	Female.
	lb. oz. drm.	lb. oz. drm.	lb. oz. drm.	lb. oz. drm.
Average weight of placenta ...	1 2 9·4	1 2 10·5	1 3 5·2	1 3 0·7
Average weight of child	6 15 10	6 13 6	7 6 15	6 14 0

It would appear from this table, not only that the offspring of a multipara is heavier than that of a primipara, but that a male infant appears to be better able to take advantage of the extra nutriment which a multipara affords than is a female infant.

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* 'Précis d'Obstétrique,' par A. Ribemont-Dessaignes et G. Lepage, vol. i., p. 130.

The relations which exist between the weight of the infant at birth and its vitality are shown by the following table.* The weights given are those of male infants; for female infants, a slightly smaller weight must be allowed:—

Weight of Infant.	Vitality.
2,000 grammes (4½ lb. approx.)	Very low
2,500 " 5½ "	Low
3,000 " 6½ "	Fair
3,500 " 7½ "	Normal
4,000 " 8 "	High
4,500 " 9 "	Very high

The length of the fœtus is very constant, and is about 20 inches. It may vary, however, between 15⅙ and 24 inches.

The average weights of the different organs at term are of importance, as they are sometimes of assistance in determining whether a dead infant has reached term or not. The following table shows the weight of the principal viscera, and is a mean between two tables which have been published by Hecker and Buhl:—†

Viscus.	Weight.	
	oz.	drm.
Right lung	1	0·93
Left lung	0	14·11
Heart	0	10·51
Thymus gland	0	4·515
Thyroid gland	0	2·822
Liver	3	11·26
Brain	12	1·019
Spleen	0	4·515
Kidney	0	6·208

THE FŒTAL SKULL.—The skull of the fœtus is the most important part, from the point of view of the mechanism of labour, as it furnishes the greatest diameters which have to pass through the pelvic cavity. Accordingly, a clear idea of its shape, size, and compressibility must be obtained before we are in a position to deal with the relative importance of the various positions which the fœtus can assume. This can best be obtained by studying the general characteristics of the fœtal head, its sutures, fontanelles, diameters, and circumferences, and by mapping it out into arbitrary regions which will, more or less, correspond with the different positions in which the head may pass through the pelvic canal.

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* 'Pediatrics,' by Rotch, p. 37.

† Ribemont-Dessaignes, 'Précis d'Obstétrique,' vol. i., p. 132.

General Characteristics.—The fœtal skull is composed of two parts—the cranium and the face. The cranium, which constitutes the larger portion of the skull, and so, from an obstetrical point of view, is the more important, is composed of eight bones. It can be subdivided into a vault and a base. The former is constituted by the lateral halves of the frontal bone, the two parietal bones, the squamous portion of the two temporal bones, and the occipital portion of the occipital bone. Its most important characteristic, from an obstetrical point of view, is to be found in the fact that these bones, instead of being more or less rigidly united to one another, are only connected by a membranous union. The result is that the vault of the cranium is essentially compressible—a most important attribute as we shall presently see. The membranous unions between the various bones are termed *sutures*, and the meeting-place of two or more sutures is termed a *fontanelle*. The base of the skull, on the other hand, is an incompressible structure, whose dimensions cannot be altered by any force, save one which is sufficient to bring about an actual rupture of its parts. It is formed by the following bones—the orbital plates of the frontal and the cribriform plate of the ethmoid, the body and wings of the sphenoid, the petrous portion of the temporal bones, and the condylar and basilar portions of the occipital bone.

The face, owing to its smaller size, is of comparative unimportance. It is composed of fourteen bones, which are so united to one another that, like the base of the cranium, the structure which they form is incompressible.

Sutures.—As has been said, the term suture (*sutura*, a stitch, hence, a union) is applied to the lines of articulation of the bones of the skull. There are, however, only certain sutures which concern the obstetrician, namely, those which furnish the bones of the cranium with their necessary mobility during labour, and with these alone we shall deal. These sutures are as follows:

(1) The sagittal, or interparietal suture, lying, as its name shows, between the parietal bones.

(2) The frontal suture, lying between the lateral halves of the frontal bone.

(3) The lambdoidal, or occipito-parietal suture, lying between the two parietal bones and the occipital bone.

(4) The coronal, or fronto-parietal suture, lying between the parietal bones and the frontal bone.

(5) The two squamous, temporal, or temporo-parietal sutures, lying between the squamous portion of the temporal bone and the frontal, parietal, and occipital bones, at each side of the skull.

Looked at from a wider standpoint than that of mere relation to different bones, we see that these sutures fall into three groups, and that each of these groups imparts a definite range of movement to the vault of the cranium:—

A. A superior longitudinal group, composed of the frontal and the sagittal sutures. It runs from near the glabella (*i.e.*, the space between the superciliary ridges, and immediately above the transverse suture of union of the frontal with the nasal and superior maxillary bones) to the apex of the occipital bone.

B. An inferior longitudinal group, composed of the squamous suture and half of the lambdoidal suture. It runs at each side of the head between the lower and outer angle of the frontal bone and the apex of the occipital bone.

C. A transverse group, consisting of the coronal suture alone.

As a result of the presence of the superior and inferior longitudinal groups, the transverse dimensions of the vault of the cranium can be diminished by pressure applied to the sides of the cranium. As a result of the lateral group, the antero-posterior diameters can be diminished by pressure applied to the fore and hind part of the cranium. It is accordingly easy to see that the practical importance of these sutures in facilitating the mechanism of labour is very great.

Fontanelles.—The term 'fontanelle' (diminutive of *fons*, a fountain) is applied to the space which exists at the meeting of two or more sutures. The origin of the term is probably due to the resemblance between the pulsations transmitted from the vessels of the brain to the fontanelles and the intermittent bubbling of a spring. The fontanelles are six in number, and fall naturally, into two groups, according to their relative importance :—

(1) *The Principal Fontanelles.*—These are single, and are two in number :—

(*a*) The anterior fontanelle, or the bregma (*βρέχειν*, to moisten), or the large fontanelle, is situated at the junction of the frontal, the coronal, and the sagittal sutures. It forms a lozenge-shaped opening through which the pulsations of the vessels of the brain are transmitted. When the bones of the cranium are compressed, as in the process of labour, the fontanelle is temporarily obliterated, and its place can only be determined by noting the intersection of four sutures. The term 'bregma' originated in the belief that the top of the head was humid in infants, and also that it corresponded with the most humid part of the brain.

(*b*) The posterior fontanelle, or the small fontanelle, is situated at the junction of the sagittal and the lambdoidal sutures. It is triangular in form and considerably smaller than the anterior fontanelle. During labour, compression of the bones of the cranium obliterates it, and its site can only be recognised by the fact that it lies at the intersection of three sutures.

(2) *The Accessory Fontanelles.*—The accessory fontanelles are double, and are two in number :—

(*a*) The antero-lateral, or the temporal fontanelles, are situated, one at each side, at the junction of the coronal and squamous sutures. They are irregularly shaped apertures, and are of no very great practical importance.

(*b*) The postero-lateral, or mastoid fontanelles, are situated, one at each side, at the junction of the lambdoidal and squamous sutures. They are also of irregular shape and of slight importance.

In addition to the assistance which the fontanelles give to the mechanism of labour by increasing the compressibility of the cranium, they also constitute important diagnostic landmarks (*points de repère*) on the surface of the skull. The method by which the principal fontanelles can be distinguished from one another has been mentioned, and it only remains to point out a possible though rare source of error. This consists in the existence of adventitious gaps along the edges of the parietal suture. As a rule, these gaps are so small in size that they do not give rise to any confusion, if, indeed, their existence is even detected. Sometimes, however, it so happens that two such gaps may occur opposite one another along the course of the suture and may then constitute a close imitation of a fontanelle. Such a gap is shown in Fig. 76, and its position and shape show how readily it might have been confounded with the anterior fontanelle.

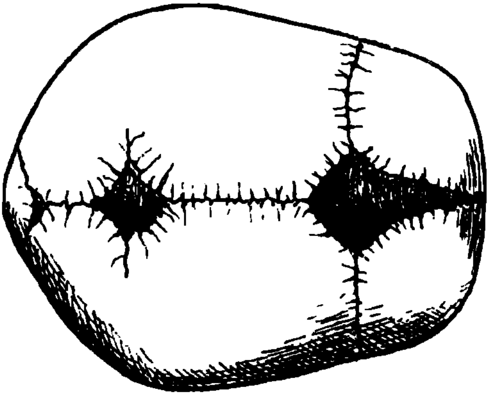

Fig. 76.—The Fœtal Skull, showing Accessory Fontanelle
(Ribemont-Dessaignes)

Diameters.—The diameters of the fœtal skull are imaginary lines drawn through the skull from one fixed point to another, by means of which we are enabled to obtain a definite idea of the size and shape of the head. The various diameters, which are usually taken into consideration, may be divided into two groups:—

A. Antero-posterior diameters. 7
B. Transverse diameters. 2.

A. *Antero-posterior Diameters.*—Under this head are grouped, for the sake of convenience, not alone all diameters which actually run antero-posteriorly, but all those which lie on a median-vertical plane of the head. If we start from the junction of the chin and the neck, and travel round the head to a point below the occipital prominence, we shall pass one by one the various points from

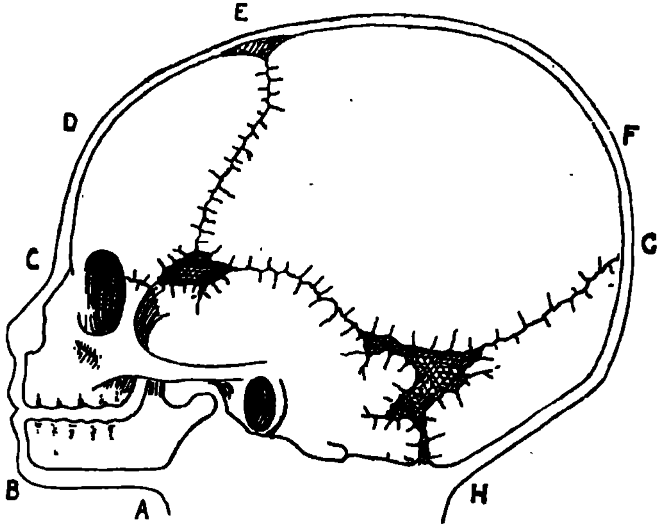

Fig 77.—The Fœtal Skull seen from the Side, showing the Points from which the Diameters are measured.

A, Junction of chin and neck; B, point of chin; C, glabella; D, most prominent point of forehead; E, large fontanelle; F, most distant point on sagittal suture; G, small fontanelle; H, lowest point on occipital bone.

which the antero-posterior diameters start, or at which they end. These points are as follows:—

(*a*) The junction of the chin and neck.
(*b*) The tip of the chin.
(*c*) The glabella.
(*d*) The most prominent part of the frontal bone.
(*e*) The anterior fontanelle.
(*f*) The most distant point on the sagittal suture from the tip of the chin.
(*g*) The posterior fontanelle.
(*h*) A point immediately below the prominence on the occipital bone.

The various diameters run as follows from these points:—

(1) One diameter starts from *a* and runs to *e*. It is termed the cervico-bregmatic, or the sub-mento-bregmatic diameter, and measures 3¾ inches.

(2) Three diameters start from *b*, and run respectively to *d*, *f*, and *g*. They are known as the fronto-mental diameter, the supra-occipito-mental diameter, and the occipito-mental

diameter. The supra-occipito-mental diameter is the longest diameter of the head, and is also known as the maximum diameter of Budin. These diameters measure respectively 3⅛, 5½, and 5 inches.

(3) One diameter starts from *c* and runs to *g*. It is known as the occipito-frontal diameter, and measures 4½ inches.

(4) Two diameters start from *h* and run to *d* and *e* respectively. They are known as the sub-occipito-frontal diameter and the sub-occipito-bregmatic diameter. They measure respectively 4 and 3¾ inches.

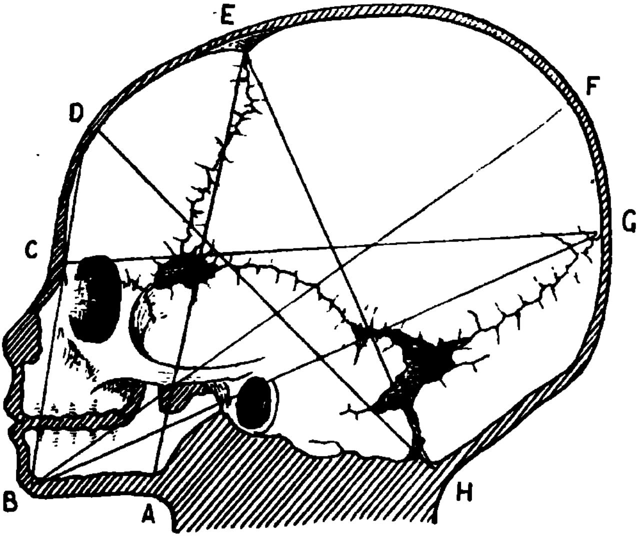

FIG. 78.—THE FŒTAL SKULL SEEN FROM THE SIDE, SHOWING DIAMETERS.
AE, Cervico-bregmatic diameter; BD, fronto-mental diameter; BF, supra-occipito-mental diameter; BG, occipito-mental diameter; CG, occipito-frontal diameter; DH, sub-occipito-frontal diameter; EH, sub occipito-bregmatic diameter.

B. *Transverse Diameters.*—The transverse diameters of the head which are of importance are two in number:—

(1) A diameter running between the parietal eminences and known as the bi-parietal diameter. It measures 3¾ inches.

(2) A diameter running between the extremities of the coronal suture and known as the bi-temporal diameter. It measures 3⅛ inches.

It must be remembered that the length of all these diameters, save the bi-temporal, can be altered to a greater or less extent by compression.

5 **Circumferences.**—The relative lengths of the different circumferences of the skull are of importance. The head during labour

has to pass through an almost rigid canal, and this can only occur when it assumes such a position that the greatest circumference which has to pass through the canal is neither greater in length nor possesses diameters which are greater in length than the circumference or the corresponding diameters of the canal through which it has to pass. The following are the four circum-

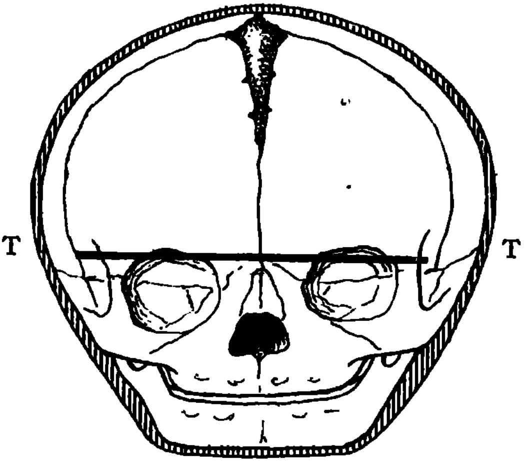

FIG. 79.—THE FŒTAL SKULL SEEN FROM IN FRONT.
TT′, Bi-temporal diameter.

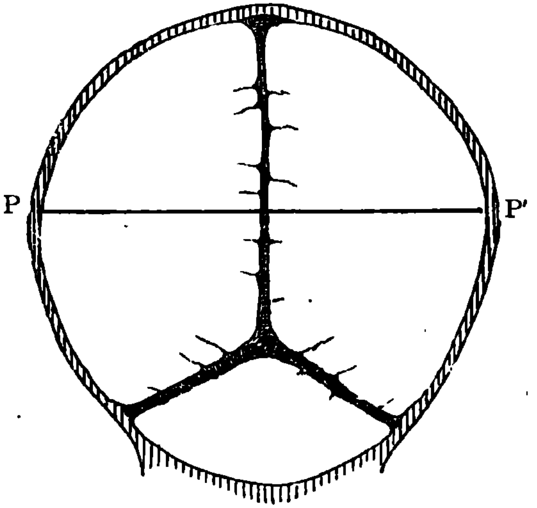

FIG. 80.—THE FŒTAL SKULL SEEN FROM BEHIND.
PP′, Bi-parietal diameter.

ferences which are respectively the greatest which have to pass through the brim in the different degrees of flexion or extension in which the head may lie:—

(1) A sub-occipito-bregmatic circumference measured round the ends of the sub-occipito-bregmatic diameter. It measures $12\frac{4}{5}$ inches, and its maximum diameters are the sub-occipito-bregmatic diameter and the bi-parietal diameter. This is the maximum circumference of the head which has to pass through the brim when the normal degree of flexion of the head is present.

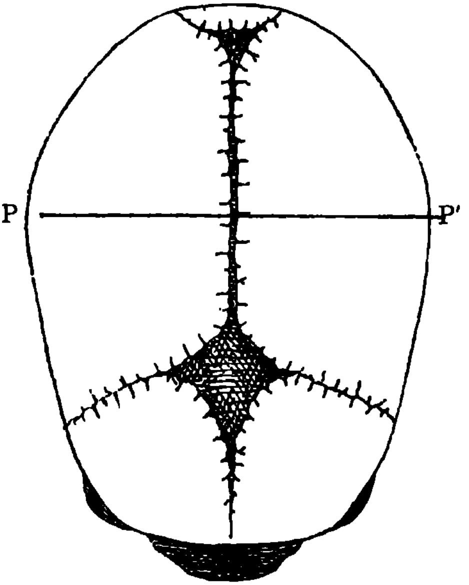

FIG. 81.—THE FŒTAL SKULL SEEN FROM ABOVE.
PP', Bi-parietal diameter.

(2) An occipito-frontal circumference measured round the ends of the occipito-frontal diameter. It measures $13\frac{3}{5}$ inches, and its
4½ maximum diameters are the occipito-frontal and the bi-parietal. It is the maximum circumference of the head that has to pass through the pelvis when the head is in a position midway between flexion and extension.

(3) A supra-occipito-mental circumference—the maximum circumference of the head—measured round the ends of the supra-occipito-mental diameter. It measures $14\frac{2}{5}$ inches, and its greatest
5½ diameters are the supra-occipito-mental diameter and the bi-parietal diameter. It is the maximum circumference of the head which has to pass through the pelvis when the head is semi-extended.

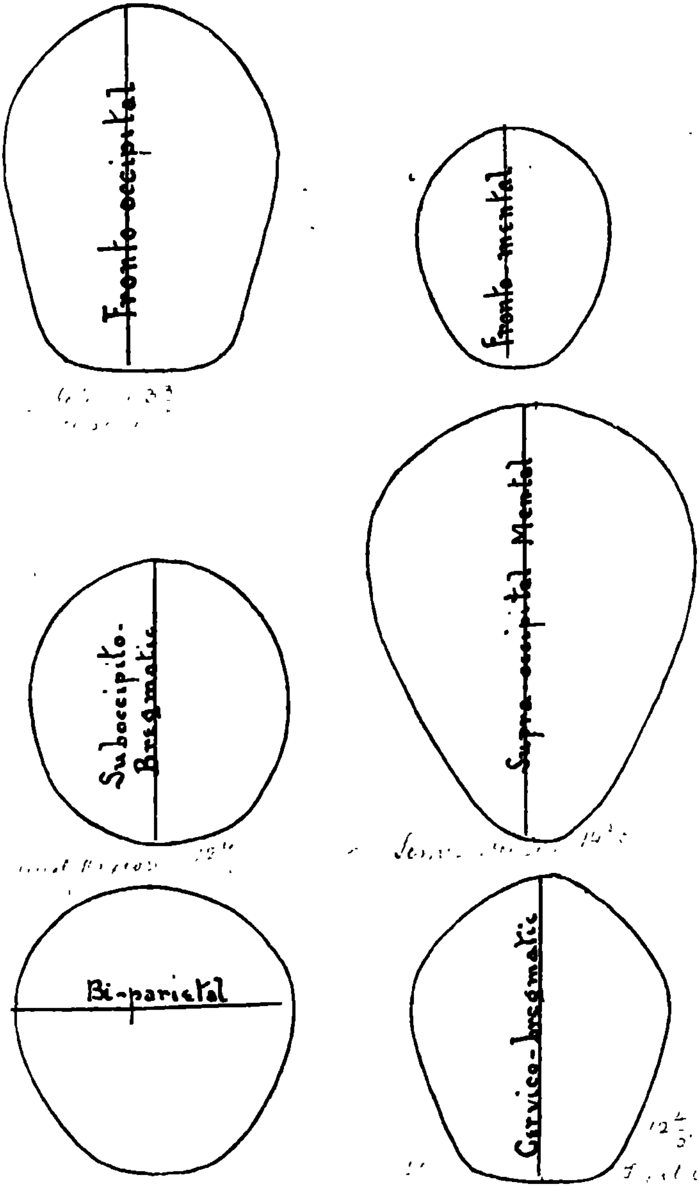

FIG. 82.—THE CIRCUMFERENCES OF THE FŒTAL SKULL MEASURED ROUND THE DIFFERENT DIAMETERS.

(From tracings of the head of a newly-born infant made by Dr. R. H. Kennan.)

(4) A cervico-bregmatic circumference measured round the ends of the cervico-bregmatic diameter. It measures 12$\frac{4}{8}$ inches, and its maximum diameters are the cervico-bregmatic and the bi-parietal diameters. It is the maximum circumference of the head which has to pass through the pelvis when the head is fully extended.

Just as the diameters of the head can be altered in length by compression, so the circumferences can be similarly affected, and can all be more or less reduced in length. The sub-occipito-bregmatic circumference can perhaps be diminished to the greatest extent and the cervico-bregmatic circumference to the least.

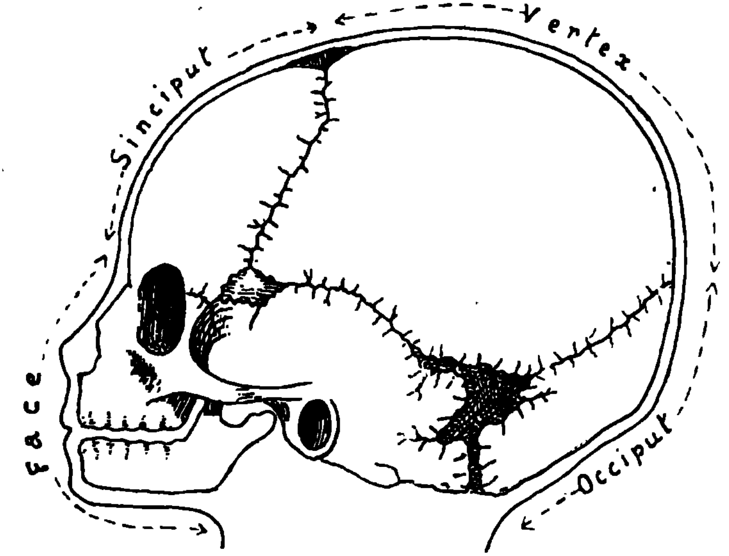

FIG. 83.—THE FŒTAL SKULL SEEN FROM THE SIDE, SHOWING THE DIFFERENT REGIONS INTO WHICH IT IS MAPPED OUT.

5 **Regions.**—In describing the antero-posterior diameters of the skull we enumerated eight fixed points between which the various diameters ran. We shall now find that certain of these points, as well as being the termination of diameters, are also natural landmarks which serve the purpose of mapping out the head into different regions. These points are as follows:—

(1) The junction of the chin and neck.
(2) The glabella.
(3) The anterior fontanelle.
(4) The posterior fontanelle.
(5) The point on the occipital bone immediately below the occipital prominence.

The parts of the head which lie between these points constitute what are known as the regions of the head. Between the junction of the chin and neck and the glabella, lies the face. Between the glabella and the anterior fontanelle, lies the forehead or sinciput (a corruption of *semi*, half, and *caput*, the head). Between the anterior and posterior fontanelles, lies the vertex. Between the posterior fontanelle and the fixed point immediately below the prominence of the occipital bone, lies the occiput.

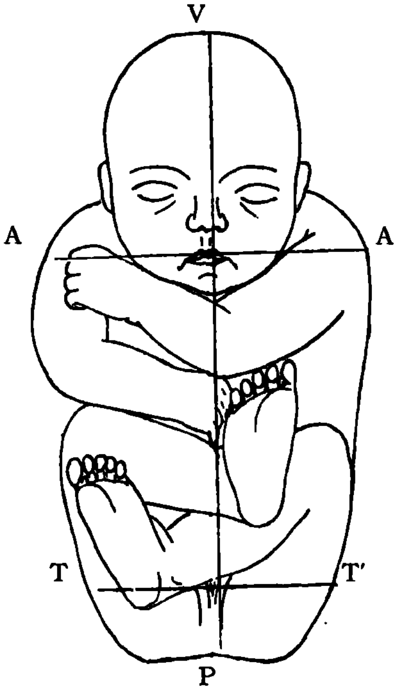

FIG. 84.—THE FŒTAL OVOID SEEN FROM IN FRONT.
VP, Vertico-podalic diameter; AA′, bis-acromial diameter; TT′, bi-trochanteric diameter.

The lateral boundaries of these regions are variously stated by different writers. It will perhaps be best to consider that the face is bounded laterally by a vertical line drawn down immediately in front of the ears; that the sinciput is coterminous with the frontal bone; that the vertex is bounded laterally by the prominences of the parietal bones; and that the occiput is coterminous with the occipital bone. It will be found later that these regions have an intimate connection with the different presentations of the head.

d THE FŒTAL TRUNK.—The dimensions of the fœtal trunk are of secondary importance to those of the skull, inasmuch as they can be so reduced by compression during labour that normally they do not interfere with the passage of the fœtus. The distance between the tips of the acromion processes of the scapula, or the bis-acromial diameter, is the greatest transverse diameter of the trunk, and measures $4\frac{1}{3}$ inches (11 cms.). It can be reduced by pressure to $3\frac{1}{3}$ inches (8·5 cms.). The greatest antero-posterior diameter of the trunk, or the sterno-dorsal diameter, lies between the sternum and the spinal column, and measures $3\frac{3}{4}$ inches (9·5 cms.). It can be reduced by pressure to $3\frac{1}{8}$ inches (8 cms.).

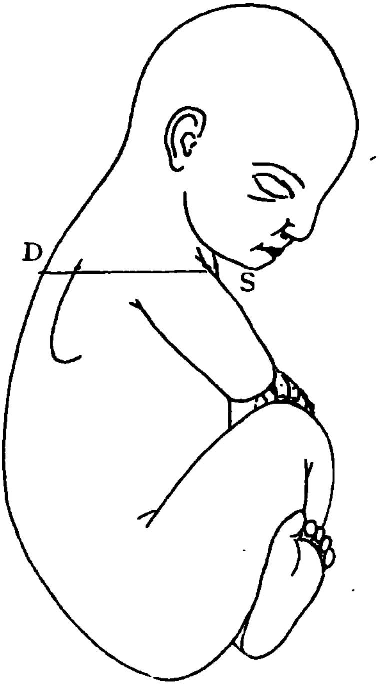

FIG 85.—THE FŒTUS SEEN FROM THE SIDE.
DS, Dorso-sternal diameter.

e THE FŒTAL BREECH.—The dimensions of the breech are, like those of the trunk, of no very great practical importance. Three diameters are usually described:—

(1) The bi-trochanteric diameter, running between the trochanters and measuring $3\frac{3}{4}$ inches (9·5 cms.), is the largest diameter.

(2) The bis-iliac diameter, running between the most distantly separated points on the iliac crests and measuring $3\frac{3}{5}$ inches (9 cms.).

(3) The sacro-iliac or antero-posterior diameter, running between the symphysis and the sacrum, and measuring $2\frac{1}{5}$ inches (5·5 cms.).

The following table, which shows the different measurements of the fœtus, may be of use for reference purposes:—

DIAMETERS.

Diameters.			Inches.	Centimetres.
Skull	Antero-posterior	Cervico-bregmatic ...	$3\frac{3}{4}$	9·5
		Fronto-mental ...	$3\frac{1}{5}$	8
		Supra-occipito-mental	$5\frac{1}{2}$	14
		Occipito-mental ...	5	12·5
		Occipito-frontal ...	$4\frac{1}{2}$	11·5
		Sub-occipito-frontal ...	4	10
		Sub-occipito-bregmatic	$3\frac{3}{4}$	9·5
	Trans-verse	Bi-parietal	$3\frac{3}{4}$	9·5
		Bi-temporal	$3\frac{1}{5}$	8
Trunk ...		Bis-acromial	$4\frac{4}{5}$	12
		Dorso-sternal	$3\frac{4}{5}$	9·5
Breech ...		Bi-trochanteric ...	$3\frac{3}{5}$	9
		Bis-iliac	$3\frac{1}{5}$	8
		Sacro iliac	$2\frac{1}{5}$	5·5
Total length			20	50

CIRCUMFERENCES.

Circumferences.	Inches.	Centimetres.
Sub-occipito-bregmatic	$12\frac{4}{5}$	32
Occipito-frontal	$13\frac{3}{5}$	34
Supra-occipito-mental	$14\frac{2}{5}$	36
Cervico-bregmatic	$12\frac{4}{5}$	32

THE RELATIONS OF THE FŒTUS TO THE UTERUS

The relations of the fœtus to the uterus and of the various parts of the fœtus to one another are expressed by four terms—attitude, lie, presentation, and position. The term 'lie' is not adopted by all writers on obstetrics. Its use, however, carries with it certain advantages to which we shall presently refer.

Attitude.—The term 'attitude' is used to imply the relations which exist between the fœtal limbs and head and the body of the fœtus. The normal attitude of the fœtus in the later months of pregnancy is what may be termed one of universal flexion. The head is flexed on the chest; the spine is slightly flexed forwards; the arms are crossed over the chest, the forearms being flexed on the upper arms; and the thighs are flexed on the abdomen and the lower legs on the thighs. One result of this attitude is that the fœtus assumes the form of an ovoid; that is to say, the most compact form which is possible for it to assume and the one which is best suited to the shape of the investing uterus. Another result is that the fœtus in its passage through the genital canal offers the minimum of resistance to the obstructions which it has to overcome.

The average dimensions of the ovoid which the fœtus thus forms are as follows:—

Diameter.	Inches.	Centimetres.
Vertico-podalic	9½ to 10	24-25
Bis-acromial	4⅝	12
Bi-trochanteric	3⅜	9
Dorso-sternal	3⅝	9·5

All these diameters can be more or less reduced by compression.

Dakin considers it advisable to regard the fœtal body as being made up of two irregular ovoids—the head and the trunk. Normally the axes of these lie parallel, or nearly so, to one another, and so they form component parts of a larger ovoid. In certain cases the smaller ovoid—namely, the head—does not preserve this relationship to the larger ovoid, and as a result an abnormal attitude is produced.

The cause of the normal attitude of the fœtus may in general terms be stated to be the necessity for adaptation between the shape of the fœtus and the shape of the uterus. In the early months of pregnancy the fœtus does not fill the uterine cavity, and, consequently, there is little or no restraint on the attitudes which it may assume. As, however, the fœtus grows and comes to fill the uterine cavity more and more completely, it finds itself subject to the passive control of the uterine walls. The result of this gentle but ever-increasing pressure is that the fœtus is compelled to bring the attitude of its head and limbs into conformity

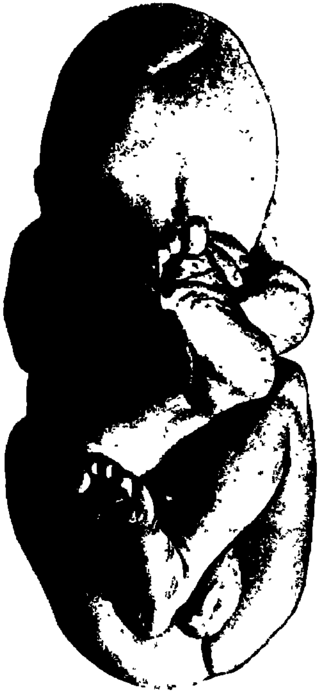

FIG. 86.—THE ATTITUDE OF THE FŒTUS *in utero*, AS SEEN FROM IN FRONT. (Bumm.)

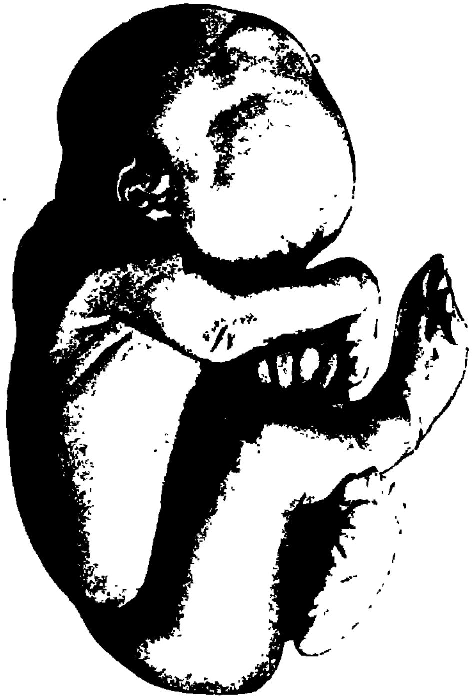

FIG. 87.—THE ATTITUDE OF THE FŒTUS *in utero*, AS SEEN FROM THE SIDE. (Bumm.)

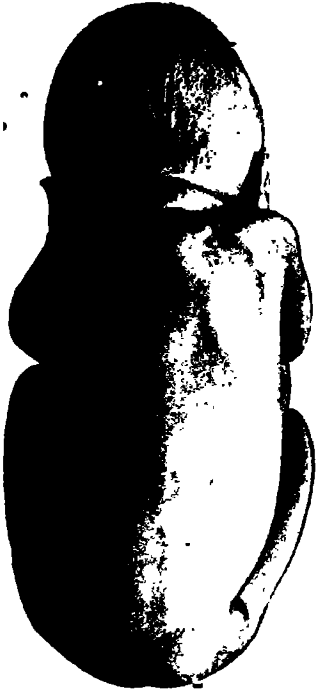

FIG. 88.—THE ATTITUDE OF THE FŒTUS *in utero*, AS SEEN FROM BEHIND. (Bumm.)

with the available space. The pressure of the uterine walls acting upon the head brings about an attitude of flexion, and the same pressure exerted upon the limbs tends to keep them approximated to the trunk of the fœtus. It will subsequently be seen that the necessity for accommodation is also largely responsible for the normal lie of the fœtus.

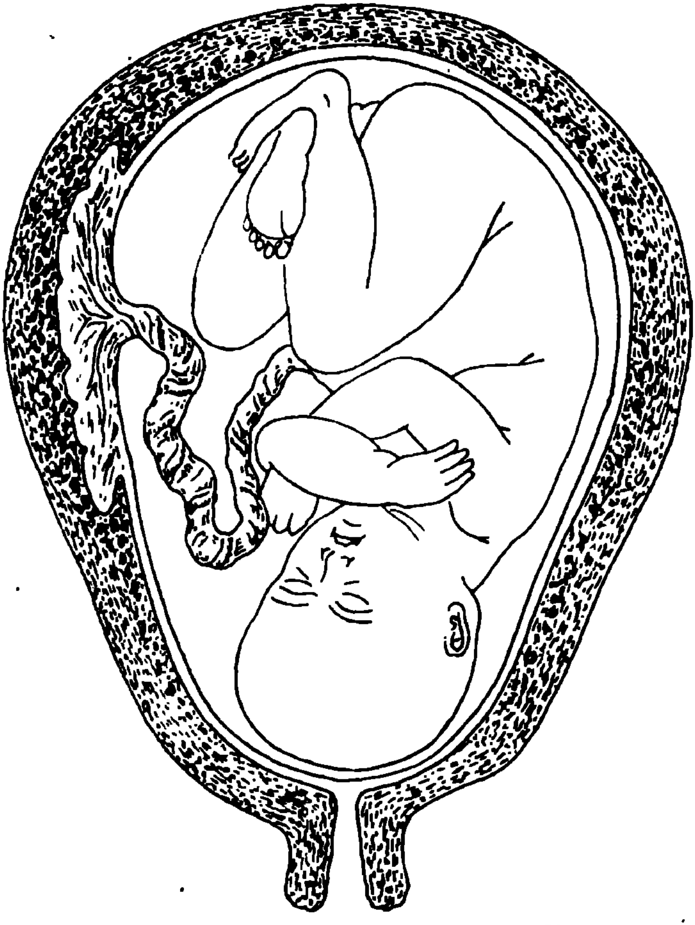

FIG. 89.—THE FULL-TERM FŒTUS IN THE UTERUS.

Note the correspondence between the ovoid shape of the uterus and that of the fœtus.

Abnormal attitudes of the fœtus are, speaking generally, any variation from the attitude which we have described as normal. They may consist in any abnormal attitude of the head, as has been mentioned, or in an abnormal attitude of the limbs. The correct attitude of the head is one of flexion on the chest, and the most common variations from this are extension—either complete or partial—and excessive flexion. The most common variations in the normal attitude of the upper limbs are extension of one or both arms upwards, beside or behind the head; downwards, beside or behind the trunk; and outwards, away from the body. The most common variations of the attitudes of the lower limbs are extension of one or both thighs, accompanied or not by a corresponding extension of one or both legs, and extension of one or both lower legs unaccompanied by extension of the thighs.

The various attitudes may be tabulated as follows:—

- *Normal*
  - Universal flexion
- *Abnormal*
  - Of Head
    - Excessive flexion
    - Extension
      - Complete
      - Incomplete
  - Of Upper Limbs
    - Extension of one or both arms
      - Upwards (beside / behind) the head
      - Downwards (beside / behind) the trunk
      - Away from body
  - Of Lower Limbs
    - Extension of one or both thighs (with / without) extension of one or both legs
    - Extension of one or both legs

Lie.—By the term 'lie' is meant the relation of the long axis of the fœtus to the uterus. When the long axis of the fœtus corresponds with the vertical axis of the uterus, the lie is said to be longitudinal. When it corresponds more or less closely with the horizontal axis of the uterus, it is said to be transverse or oblique. A longitudinal lie of the fœtus is the normal lie, and the proportion of cases in which it occurs is overwhelmingly greater than the proportion in which a transverse lie occurs. In 100 cases of labour the fœtus lies longitudinally in 99·44 per cent., leaving the small proportion of 0·56 per cent. for transverse lies. The cause of the almost universal occurrence of a longitudinal lie is very obvious. As we have already seen, the long axis of the fœtal ovoid is the vertico-podalic axis, while the long axis of the uterine ovoid is the vertical axis. The relations of the dimensions of the uterine ovoid to those of the fœtal ovoid are such, that while there is ample room for the fœtal ovoid when its long axis corresponds with the long axis of the uterus, there is insufficient room for it to lie in any other position. Consequently, as soon as the fœtus becomes of sufficient size to fill the uterine cavity, and so to be pressed upon by the uterine walls, it is guided round by this pressure until its long axis corresponds with the long axis of the uterus, or, in other words, until its lie is longitudinal. If, however, there is marked alteration in the shape of the uterine cavity or of the fœtus, by which either of them lose its ovoid character, a transverse or oblique lie may result.

Presentation.—The presentation is the term applied to that part of the fœtus which has engaged, or is tending to become engaged, in the pelvic cavity, or, in other words, it is that part of the fœtus which is first reached by the finger when making a vaginal examination.

The different presentations can be divided into three main groups:—

A. Cephalic presentations, or presentations of the head.

B. Pelvic presentations, or presentations of the breech and lower limbs.

C. Shoulder presentations, or presentations of the trunk or upper limbs.

A cephalic or a pelvic presentation occurs when the lie is longitudinal, a shoulder presentation when the lie is transverse. The latter, therefore, is a very rare occurrence. Cephalic presentations occur in a very much larger proportion of cases than do pelvic presentations. In 96·88 per cent. of all cases in which the lie is longitudinal, the head presents, while a pelvic presentation only occurs in the remaining 3·12 per cent. There must be very definite causes for such a preponderance of one group of presentations over another, and these causes we now propose to discuss.

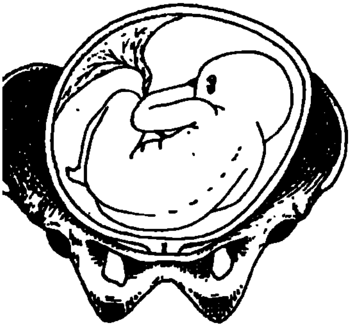

FIG. 90.—DIAGRAM OF THE FŒTUS *in utero* IN THE EARLY MONTHS.

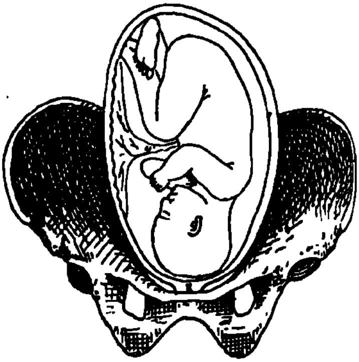

FIG. 91—DIAGRAM TO SHOW RESTRAINING EFFECT OF THE SHAPE OF THE UTERUS ON THE POSITION OF THE FŒTUS IN A LONGITUDINAL LIE.

In all probability the preponderance of cephalic presentations is due, not to one, but to several factors. The most commonly recognised of these are as follows:—

(1) The relation between the shape of the fœtus, and the shape of the uterus.

(2) The effect of gravity on the fœtus.

(3) The movements of the fœtus.

(1) *The Relation between the Shape of the Fœtus and the Shape of the Uterus.*—As has been already stated, the shape of the uterine

cavity and the controlling pressure exerted by its walls have a causal effect upon the attitude and lie of the fœtus; we shall now see that they have a similar effect upon its presentation. The fœtus, when in its normal attitude, has an ovoid form. The larger end of this ovoid is composed of the breech and lower limbs, the smaller end of the head. The uterine cavity is also of an ovoid shape; the fundus constitutes the larger end of the ovoid, the lower portion of the uterus the smaller end. It is thus at once obvious that if the fœtus is to take advantage of the close correspondence which exists between its shape and that of the uterus, and so obtain the maximum amount of room, it must lie longitudinally with the larger end of its ovoid in the larger end of the uterine ovoid—that is to say, the head must present. In this presentation, the fœtus is uniformly pressed upon by the uterine walls, while in any other presentation the pressure varies over the different parts of its body. Consequently, the passive control of the uterus tends to keep the fœtus in a cephalic presentation, if such already exists, whilst it tends to change any other presentation into a cephalic presentation. If there is any alteration in the normal form of the fœtal or the uterine ovoid, then, although accommodation still exists, it produces different consequences. If the cephalic pole of the fœtus is larger than the podalic pole, the former is usually found at the fundus. If the fundal pole of the uterine cavity is diminished in size, or if the pelvic pole is increased in size, the larger pole of the fœtus will usually be found occupying the latter.

(2) *The Effect of Gravity on the Fœtus.*—It has been determined experimentally that the centre of gravity of the full-term fœtus is situated about the level of the shoulders, nearer the right shoulder than the left, and nearer the posterior surface of the fœtus than the anterior (Mathews Duncan). As a result of this, if the fœtus is completely immersed in a fluid of the same specific gravity as the liquor amnii, it floats on its back, its head lower than its breech, and its right shoulder slightly lower than its left. It is obvious, then, that so long as the fœtus is free to move in the uterus, it will lie with its cephalic pole lower than its podalic pole, and so favour the occurrence of cephalic presentations.

(3) *The Movements of the Fœtus.*—The movement of the fœtus, and especially the movements of the lower limbs, are often sufficiently strong to cause an alteration in the presentation. This alteration is most prone to occur when the fœtus lies in such a manner that its lower limbs can press against the rigid walls of the pelvis. Active movements on the part of the fœtus will then tend to push the podalic pole away from the pelvic brim, and towards the fundus. When the movements cease, the podalic pole may again return to its former situation, only to be again pushed away by a recurrence of the movements. If, however, the movements, helped by the other factors which have been mentioned, are sufficiently strong to bring the podalic pole into

the fundus of the uterus, then the resistance to fœtal movements is almost completely lost, and the tendency to a change of presentation ceases, as a flaccid uterus provides no resistance to the movements of the limbs, and a contracted uterus, by accentuating the ovoid shape of the uterus, effectually maintains a cephalic presentation.

Other theories as to the causation of cephalic presentations have been brought forward from time to time. They are not, however, of sufficient importance to render it necessary to call attention to them. The three factors which we have mentioned are in all probability the associated causes of cephalic presentations, and may be said to jointly act as follows. In the early months of pregnancy, the fœtus is subject to but little restraint by the uterine walls, and consequently it lies as is determined by gravity. As the head increases in size, and the centre of gravity approaches the shoulders, the presentation tends to become cephalic. As the lower pole of the fœtus grows, and the ovoid form is accentuated owing to the fœtus assuming its normal attitude, the effect of the shape of the uterus begins to manifest itself, and the fœtus is found in a longitudinal lie. If the presentation is cephalic, the tendency of the factors enumerated is to cause it to persist. If, on the other hand, the presentation is pelvic, the tendency of these factors is to bring the head down and the podalic pole upwards. Sooner or later this change occurs, and once it has occurred a cephalic presentation persists.

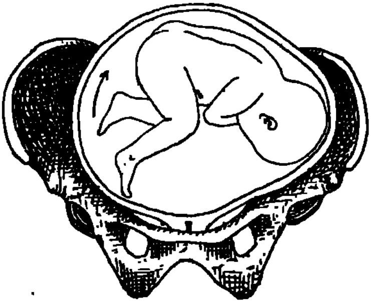

FIG. 92.—DIAGRAM TO SHOW EFFECT OF FŒTAL MOVEMENTS IN CAUSING HEAD PRESENTATION.

The different presentations, which are grouped under the inclusive term ‘cephalic’ presentation, are five in number, and are directly due to variations in the attitude of the head of the fœtus. If the fœtus preserves its normal attitude the vertex presents. If the head is more flexed than normally, the posterior fontanelle presents. If the head is midway between flexion and extension, the anterior fontanelle presents. If there is a slight degree of extension present, the sinciput or brow presents. While, if the head is fully extended, the face presents. Two more presentations are sometimes added to this list—anterior and posterior parietal presentations. We have, however, come to the conclusion that to do so unnecessarily complicates the list of presentations, inasmuch as it adds presentations which are the result, not of flexion or of extension, but of lateral deviations of the head. Further, whereas the presence of one of the foregoing presentations excludes the presence of any other, if we add parietal presentations to the list, we have to admit that two presentations can occur at the same time. For, if in a vertex presentation the head is deviated towards one or other shoulder, a parietal presentation is also present. This is apt to lead to confusion, and consequently we prefer to refer to cases of lateral deviation of the head as obliquities of the head, and not as parietal presentations.

Under the inclusive term 'pelvic presentation,' two presentations are included, and these again are the result of variations in the attitude of the fœtus.

If the attitude is normal, a complete pelvic presentation will result. If the limbs depart from their normal attitude, an incomplete pelvic presentation will result, and the breech alone, one or both knees, one or both feet, or a foot and a knee, may be found presenting, according to the variation in the normal attitude which exists.

In longitudinal lies, the exact presentation of the fœtus, particularly when it is cephalic, is of the utmost importance. If the vertex presents, it is certain that labour will be as favourable as the other circumstances of the case permit. If, on the other hand, the face presents, the presumption is that labour will not be favourable either for the mother or the fœtus. While, if the brow or sinciput presents, it is certain that labour will be unfavourable for both mother and fœtus, unless other circumstances, such as an exceptionally roomy pelvis, facilitate the passage of the large diameters of the head. In transverse lies, on the other hand, the exact presentation is not of any very great importance, since it is overshadowed by the general fact that there is no presentation in this lie in which the fœtus can be delivered under otherwise normal circumstances. If the attitude of the fœtus is normal, the shoulder almost invariably presents. If the normal attitude is lost, an elbow, a hand, the ribs, or perhaps one or both hands and feet may present. We shall not consider, therefore, these as separate entities, but group them under the general heading 'transverse lie,' or 'shoulder presentation.'

The following is a list of the different presentations, their frequency, and the attitude of the fœtus which causes them :—

CEPHALIC PRESENTATIONS.

1. *Vertex Presentation.*—In this, the head is in its normal attitude of flexion, and as a result the vertex lies lowest. It occurs in almost 95·53 per cent. of all cases.

2. *Face Presentation.*—In this, the attitude of the head is one of complete extension, with the result that the face lies lowest. It occurs in 0·6 per cent. of all cases.

3. *Brow or Sinciput Presentation.*—In this, the head is slightly extended, with the result that the forehead lies lowest. It occurs in 0·2 per cent. of all cases.

4. *Anterior Fontanelle Presentation.*—In this, the head is midway between flexion and extension, with the result that the anterior fontanelle lies lowest. The proportion of cases in which this and the following presentation occur is so small that no reliable statistics of their frequency can be given. They are included in the percentage of vertex presentations.

5. *Posterior Fontanelle Presentation.*—In this, the head is more than normally flexed, and, consequently, the posterior fontanelle lies lowest. If flexion is still more exaggerated, the occiput may present, a condition termed by some an occipital presentation.

PELVIC PRESENTATIONS.

1. *Complete Pelvic Presentation.*—In this, the fœtus lies in its normal attitude, and as a result the breech and feet present. It is difficult to ascertain the exact proportion of cases in which this presentation occurs, as in most statistics all cases of pelvic presentation are classified together, and amount to 3·11 per cent. of all cases.

2. *Incomplete Pelvic Presentation.*—In this, the normal attitude of the fœtus is altered, with the result that three sub-presentations are found :—

(*a*) The thighs are flexed and the lower legs are extended and lie along the trunk of the fœtus, with the result that the breech alone presents—breech presentation proper.

(*b*) One or both thighs are extended, the legs remaining flexed, with the result that one or both knees present—knee presentation.

(*c*) One or both thighs and legs are extended, with the result that one or both feet present—footling presentation.

SHOULDER PRESENTATION.

As has been already mentioned, the practical importance of the exact presentation in transverse lie is not great. By far the commonest presentation is a shoulder. It occurs in 0·56 per cent. of all cases.

It is quite possible that objection may be taken to the inclusion of fontanelle presentations in the list of cephalic presentations, on the ground that they are only the result of slight secondary changes in a vertex presentation. All presentations, however, may be divided into primary, and secondary or resultant. Where there is no deformity of either the uterus or the fœtus, there is only one primary presentation of the head—*i.e.*, a vertex presentation, and any other presentation occurring before labour has commenced is the result of deformity. Consequently, all the other head presentations must be regarded as secondary presentations resulting from some interference with the mechanism of labour. The exact secondary presentation, which results, depends on the form and the degree of this interference, and its importance must be estimated, not by the extent of the displacement of the head which occurs, but by the nature of the probable causal agents of the displacement, and by the length of the diameters of the head which have to pass through the pelvis. For example, a brow presentation is the result of a less degree of displacement of the head than is a face presentation, but it is a far more important condition, as it brings into the brim of the pelvis diameters which are frequently too large to pass through the latter. Similarly, a fontanelle presentation is produced by a very slight displacement of the head, but its occurrence, as we shall subsequently see, tends to show the existence of a degree of pelvic narrowing which is sufficient to alter the mechanism of labour. Consequently, it cannot be regarded as of less importance than a face presentation. If a fontanelle presentation is to be considered as a variety in the mechanism of a vertex presentation, a face or a brow presentation—*i.e.*, any resultant presentation—must be similarly considered, as it is not logically possible to differentiate between them. Consequently, we consider that it is necessary to adopt the foregoing extended classification of presentations.

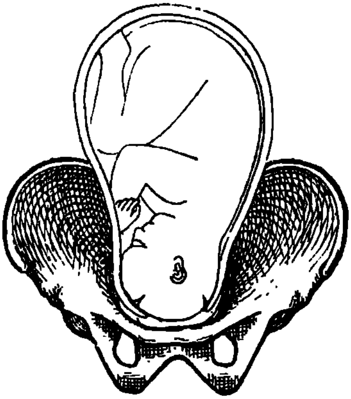

FIG. 93.—DIAGRAM OF VERTEX PRESENTATION.

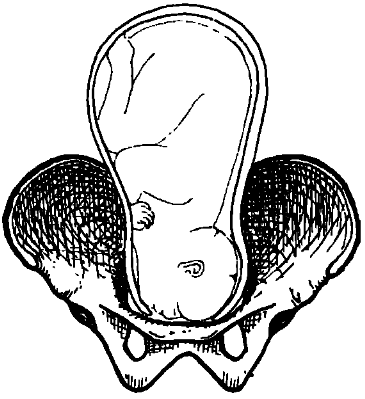

FIG. 94.—DIAGRAM OF FACE PRESENTATION.

It is a common mistake to consider that the presentation once fixed is unchangeable, even though the occurrence of secondary presentations clearly proves the possibility of the presentation altering. The error is in large part due to the fact that works on obstetrics must, for the sake of clearness, describe each presentation separately, and, consequently, students and others are led into the belief that a vertex presentation is through the whole of labour a presentation of the vertex, and a brow presentation a presentation of the brow. This is very far from being the case, and especially, in view of the extended classification of presentations which we have adopted, this point must be clearly

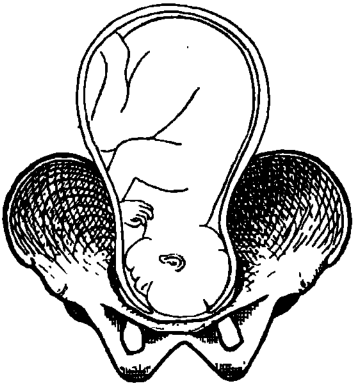

FIG. 95.—DIAGRAM OF BROW PRESENTATION.

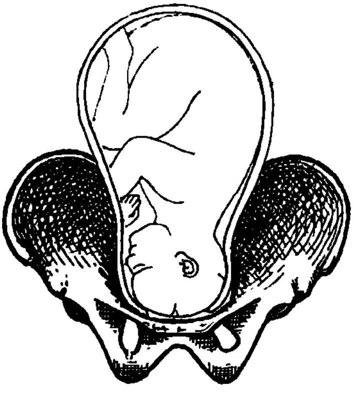

FIG. 96.—DIAGRAM OF ANTERIOR FONTANELLE PRESENTATION.

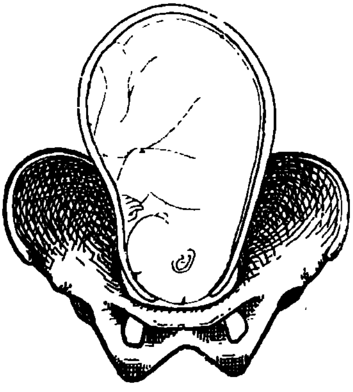

FIG. 97.—DIAGRAM OF POSTERIOR FONTANELLE PRESENTATION.

understood. A vertex presentation changes in the normal mechanism of labour as it passes through the brim into a posterior fontanelle presentation. Under abnormal circumstances, it may change into a posterior fontanelle presentation before it can enter the brim, or into an anterior fontanelle presentation; or it may change into a brow or a face; whilst, similarly, a brow or a face presentation may change into a vertex. This being so, how is it possible to classify presentations? They are classified according to the presentation in which the fœtus passes, or attempts to pass, through the brim of the pelvis—*i.e.*, through the area of maximum resistance, and any previous or subsequent variations in the presentation are neglected. This brings us to a very important practical point. We can never be certain what the presentation is going to be until the head is fixed in the brim of the pelvis.

The different lies and presentations may be tabulated as follows:—

Longitudinal lies (99·44 per cent.)	Cephalic presentation (96·33 per cent.)	Vertex (95·53 per cent.)	
		Face (0·6 per cent.)	
		Brow (0·2 per cent.)	
		Anterior fontanelle	
		Posterior fontanelle	
	Pelvic presentation (3·11 per cent.)	Complete pelvis	
		Incomplete pelvis	Breech
			Knee
			Foot
Transverse lies (0·56 per cent.)	Shoulder presentation	Shoulder	
		Elbow	
		Hand	

Position.—The term 'position' is used to express the relation between some fixed part of the fœtus *in utero* and the middle line of the mother. According to the lie of the fœtus, different parts are chosen to indicate the position. In longitudinal lies, the back is used as what may be termed the indicator (the French *point de repère*). If the back of the fœtus is turned towards the left side of the mother, the fœtus is said to be in the first position; if the back is turned towards the right side, the fœtus is said to be in the second position. In transverse lies, the head is used as the indicator. If the head of the fœtus is on the left of the middle line, the fœtus is said to be in the first position; if on the right of the middle line, in the second position. These two positions can be subdivided, if necessary, into two sub-positions, according as the back is turned towards the front or the back of the mother. In this manner, the four positions of Naegele are obtained in longitudinal lies, or the four positions of Winckel in transverse lies.

There does not, however, appear to be any real reason for recognising four positions. In the first place, the mechanism of labour is very little affected by the fact that the back is directed anteriorly or posteriorly. In the second place, even if four positions are recognised, still the fœtus may lie in a position which does not correspond with any of them—*i.e.*, with back directed neither forwards nor backwards, but midway between these two positions. In the third place, any necessity for defining the position of the fœtus exactly can be met by qualifying the term first and second position by adding the words 'with the back in front' or 'with the back behind,' as the case may be. Accordingly, we shall describe only two positions, but in each case we shall also add the positions of Naegele or Winckel for the benefit of those who are accustomed to such a classification.

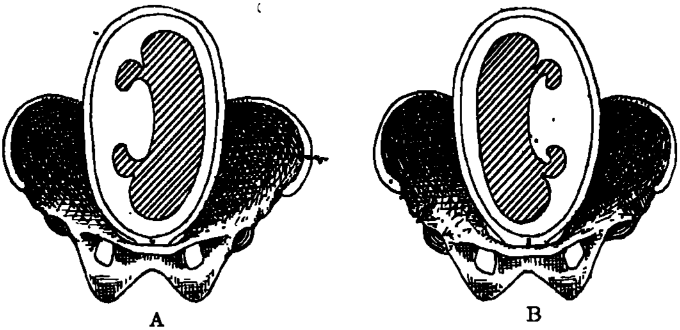

Fig 98.—Diagram of 'Position' in Longitudinal Lie of Fœtus.

A, First position, back to left; B, second position, back to right.

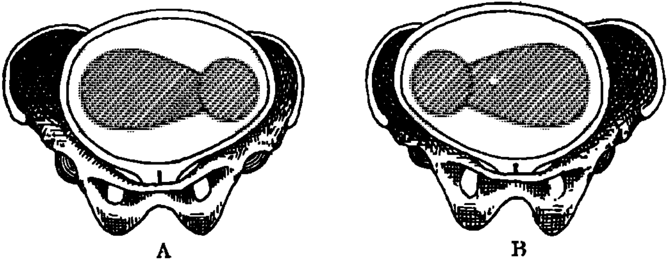

Fig. 99.—Diagram of 'Position' in Transverse Lie.

A, First position, head to left; B, second position, head to right.

In longitudinal lies, the commonest position is the first position with the back in front. The proportion of cases in which it occurs is greatest in cephalic presentations, as we shall presently see. In pelvic presentations, it is also more frequent, but its preponderance is not so marked. The preponderance of first positions in cephalic presentations is largely attributable to the influence of gravity. As has been already said, if a fœtus is immersed in a fluid of the same density as the liquor amnii, it floats on its back, its head lower than its breech, and its right shoulder lower than its left. When the mother stands upright, the uterus falls forwards and slightly to the right, so that its most dependent part is found in the right iliac fossa. Consequently, the fœtus, under the influence of gravity, tends to lie with its head presenting, its back anterior, and its right shoulder in the right iliac fossa. That is to say, it lies in the first position with the back in front. Another cause of the frequency of this position is to be found in the relation between the horizontal diameters of the uterus and the horizontal diameters of the fœtus. The greatest horizontal diameter of the uterus is the transverse diameter, and the greatest horizontal diameter of the fœtal ovoid is the antero-posterior diameter. Accordingly, the fœtus accommodates itself best to the shape of the uterus when it lies with its antero-posterior diameter in the transverse diameter of the uterus. Now, in consequence of the usual dextro-torsion of the uterus, its transverse diameter corresponds with the right oblique diameter of the pelvis, and consequently the antero-posterior diameter of the fœtal ovoid is found in the same position. A third reason for the preponderance of the first position with the back in front may perhaps be found in the fact that, owing to the presence of the rectum, the left oblique diameter of the pelvis is slightly shorter than the right, and that, consequently, there is more space for the long diameters of the head in the larger right oblique diameter.

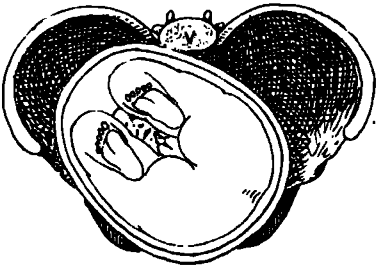

FIG. 100.—THE FŒTUS AS SEEN FROM ABOVE, SHOWING THE CORRESPONDENCE BETWEEN THE ANTERO-POSTERIOR DIAMETERS OF THE FŒTAL OVOID, THE TRANSVERSE DIAMETER OF THE UTERUS, AND THE RIGHT OBLIQUE DIAMETER OF THE PELVIS.

The various positions may be tabulated as follows:—

Longitudinal lies	First position, back to the left	In front, first position of Naegele
		Behind, fourth position of Naegele
	Second position, back to the right	In front, second position of Naegele
		Behind, third position of Naegele
Transverse lies	First position, head to the left	Back in front, first position of Winckel
		Back behind, fourth position of Winckel
	Second position, head to the right	Back in front, second position of Winckel
		Back behind, third position of Winckel

PART II

OBSTETRICAL ASEPSIS AND ANTISEPSIS
THE OBSTETRICAL ARMAMENTARIUM
OBSTETRICAL DIAGNOSIS

CHAPTER I

OBSTETRICAL ASEPSIS AND ANTISEPSIS

History—Definitions—The Causes of Septic Infection—The Bacteriology of the Genital Tract: the Vulva, the Vagina, the Uterine and Cervical Cavities—The Prevention of Sepsis: the Disinfection of the Hands, Sterilisation of Instruments, the Disinfection of the Genital Passages, the Administration of Douches.

IN 1847, Semmelweis of Vienna drew the attention of his colleagues to the enormous death-rate from puerperal fever in the lying-in wards of the General Infirmary of Vienna—a mortality which exceeded 12 per cent. He was led by various incidents to ascribe this mortality to the infection of the patients by students, who came straight from the dissecting-rooms to the lying-in wards, and there made vaginal examinations with insufficiently washed hands. With the view of diminishing this terrible mortality, he enforced certain regulations, particularly the thorough washing of the hands in a solution of chlorine before making vaginal examinations, with the result that the death-rate was, within a comparatively short period, reduced from 12·24 per cent. to 1·27 per cent. In spite of this clear demonstration of the cause of the death-rate, the general adoption of cleanliness and disinfectants was very slow. For many years, puerperal fever was still considered to be due to ill-defined causes, such as the weather, the temperament of the patient, and the workings of Providence; and, what was, perhaps, a still greater cause of confusion, puerperal fever was considered to be a disease peculiar to parturient women, and its connection with the 'surgical' infection of wounds and with pyæmia remained unrecognised.

The statistics of the great Rotunda Hospital show that the results of the introduction of asepsis into the practice of that Institution were very marked, although at no time was the death-rate at all comparable with that of the Viennese Hospital at the time of Semmelweis, owing doubtless to the fact that there was no medical school or dissection-rooms in association with the maternity department. During the years 1846 to 1853—that is, during the time at which Semmelweis was teaching at Vienna, 13,501 women were confined in the Rotunda Hospital.* Of this number 177 died, being a percentage mortality of 1·31, a wide difference indeed from Semmelweis's figures. During the years 1868 to 1875, 9,760 women were confined in the hospital.* Of this number 179 died, being a percentage mortality of 2·21. More than twenty years had elapsed, but instead of a diminution in the mortality, an actual increase of almost one per cent. had taken place. During the closing years of the nineteenth century, from 1893 to 1900,† 10,219 women were confined in the hospital. Of this number 38 died, a percentage mortality of 0·37—that is to say, in a further period of twenty-five years the mortality was reduced to a sixth of what it had been.

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* 'Lectures on Midwifery,' by E. W. Murphy, M.D. London, 1862, p. 705.

These figures suggest two interesting questions—How was it that at a time when in Vienna the death-rate was 12 per cent., the death-rate in Dublin was 1·31 per cent.? And why should there have been, after a lapse of twenty years, an increase in the death-rate of nearly one per cent., followed after a similar period by so marked a decrease? The answer to the first question has been in part given, but it is probable that another reason was also to be found in the fact that in Dublin the use of chlorine as a disinfectant had been practically applied some thirty years before Semmelweis proved its value in Vienna. Collins, Master of the Rotunda Hospital from 1826 to 1833, was obliged to temporarily close the hospital on account of a severe epidemic of puerperal fever. While it was closed, he had all the wards in rotation 'filled with chlorine gas in a very condensed form for the space of forty-eight hours';‡ the floors and woodwork were also painted over with chloride of lime, which was left on for forty-eight hours more. This was done in the year 1829, and from that time to the end of his mastership in 1833, he 'did not lose one patient from this disease.' The number of deaths which had occurred in the hospital in the four years preceding this disinfection were 81, 33, 43, 34, and in the four years following it 12, 12, 12, 12.

The second question also admits of a very probable answer. During the period 1853 to 1868, there was no real advance in the knowledge of the prevention of puerperal fever. Hygienic advances were doubtless made, but these, though important in themselves, are not sufficient to cope with the factors of septic infection. On the other hand, there was a distinct advance in what, for want of a better term, we may call the science of midwifery as opposed to the practice of this subject. The use of the forceps became more general, and various other operations were more commonly practised, with the results that the opportunities for infecting a patient were indefinitely increased.

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* 'Clinical Reports of the Rotunda Hospital,' by George Johnston. 1868-1875.

† 'A Short Practice of Midwifery,' by Henry Jellett. Fourth edition, 1903, pp. 534, 535.

‡ 'A Practical Treatise on Midwifery,' by Robert Collins. London, 1835, p. 388.

The enormous improvement in the death-rate from this time on is readily accounted for. The discoveries of Lister and Pasteur lead to the identification of puerperal fever and septic infection, or perhaps it is more correct to say they lead to the discovery that there was no such thing as puerperal fever, and that the conditions which had been grouped under this term were identical with the results of the septic infection of wounds. Once this point was clearly grasped by medical men, the improvement in the mortality from septic infection became greater each year, until at the present time lying-in hospitals, which in former days were the most dangerous, are now the safest places in which a woman can be confined.

With the foregoing statistics before us, we need not dwell upon the necessity for the rigid practice of asepsis and antisepsis in obstetrical practice. It is essential in an obstetrician that he should recognise this necessity and act accordingly. An obstetrician who does not recognise this, no matter how skilled he may be, will be a source of danger rather than of safety to his patient. We shall therefore first describe the sources of septic infection, as when they are known the methods of avoiding them will be more readily understood. Before doing so, however, it will be well to define certain terms of which we shall make use.

By the term 'sterile' is meant the entire absence of living micro-organisms. By the term 'aseptic' is meant the entire absence of septic organisms. By the term 'antiseptic' is meant any substance which is capable of inhibiting the growth of, or of destroying; septic organisms. These are all definite terms, but the next term is by no means so definite—*i.e.*, 'surgical cleanliness.' The meaning which we should like this term to convey and the meaning which we are compelled by circumstances to attach to it are widely different. The object of all research into the different modes of sterilisation is to make surgical cleanliness correspond as closely as possible with sterility. This, unfortunately, it is as yet impossible to do in the majority of cases Sterility is almost impossible on account of the number of saprophytic organisms which are in the air. The highest form of surgical cleanliness to which we can attain is in the case of those substances which can be exposed to the prolonged action of heat—*e.g.*, dressings and instruments, and even here the term is at best usually synonymous with asepsis, while in the case of our hands, or of the skin of the patient, we can rarely, if ever, attain to such a height. In their case, the most that can be hoped for is that the external layers of the skin are rendered aseptic while the deeper layers are still swarming with micro-organisms. Fortunately, as practice proves, this is sufficient. The term 'surgical cleanliness' must, then, be taken to mean the nearest approach to sterility which can be obtained by the careful carrying out of those methods which experience has proved to be most reliable. The last term, 'sterilisation,' is that usually applied to the process by which hands, instruments, etc., are rendered surgically clean. It is obviously not a perfectly correct term, but inasmuch as it conveys the end at which we are aiming, and so always keeps it before us, it is an extremely suitable one.

Lastly, there are two terms which have been, and are still, used to denote two supposed sources of septic infection :—'Autogenetic infection,' or, more shortly, 'auto-infection,' is the term applied to the inoculation of the patient by bacteria which are present under normal circumstances in the body. 'Heterogenetic infection,' or 'hetero-infection,' is the term applied to the inoculation of the patient by bacteria which have been directly or indirectly introduced from without, and which are not present in the body under normal circumstances. A clear distinction must be made between these terms, inasmuch as it is doubtful whether auto-infection ever occurs.

The cause of septic infection is the invasion of the tissues of the body by septic organisms; and in this term we include the streptococcus and the staphylococcus, the gonococcus and the diphtheria bacillus. It is obvious that any of these bacteria may be introduced into the genital tract from without, and so give rise to hetero-infection. If, however, they are also present in the genital tract under normal circumstances, awaiting, as it were, a favourable opportunity for gaining access to the tissues of the body, then auto-infection is also possible. Whether auto-infection is or is not possible is a most important question to decide, as on the answer to it are necessarily based the various methods of preventing the occurrence of septic infection. To answer it, we must study the bacteriology of the genital tract.

THE BACTERIOLOGY OF THE GENITAL TRACT

The genital tract may for bacteriological purposes be divided into three zones, each of which will be found to have its own bacterial peculiarities. These zones are as follows:—

(1) Outside the hymen—*i.e.*, the vulva.
(2) From the hymen to the external os—*i.e.*, the vagina.
(3) Above the external os—*i.e.*, the cervical and uterine cavities.

The Vulva.—The vulva and all the parts surrounding it may be termed the septic area of the genital passages. Their bacteriology is more or less identical with that of the skin of the rest of the body, save that owing to the juxtaposition of the anus the bacterial flora is perhaps more abundant. The bacteria most commonly met with are the *Streptococcus* and *Staphylococcus aureus*, the *Staphylococcus albus* and the *Staphylococcus epidermidis albus*, the vaginal bacillus, *Bacillus coli communis*, numerous forms of saprophytic bacteria, and yeast cells. It must be remembered that infection by these bacteria cannot be termed auto-infection, any more than the infection carried on the patient's fingers to the genital tract could be so termed. The presence of bacteria on the vulvar skin is accidental, as in the case of the skin of other parts of the body, and, consequently, infection by these bacteria is distinctly heterogenetic.

The Vagina.—The bacteriology of the vulva has been dismissed in a few words, but that of the vagina is more complicated and uncertain. The difficulty of determining exactly the bacterial conditions of the vagina in health is great, a fact which is well shown by the contradictory results obtained by competent authorities.

In 1892, Doederlein published a monograph* on vaginal secretion, in which he incorporated the results of his examination of the vaginal secretion of 195 pregnant women. He believed that he could distinguish two varieties of secretion—normal and abnormal. The normal secretion was a thick, dryish, crumbly, white material, with a very markedly acid reaction. On microscopical examination, it was found to be composed of epithelial cells, of large numbers of long, tolerably thick bacilli, and occasionally of a few yeast-cells. The abnormal secretion, on the other hand, was more fluid in character and purulent in appearance, and less acid or occasionally alkaline or neutral in reaction. Upon microscopical examination, it was found to contain leucocytes and epithelial cells, and many varieties of bacteria, especially cocci and short bacilli. Cultures made from the normal secretion were, as a rule, sterile, but from the abnormal secretion various pyogenic organisms could be isolated. Classifying the cases he examined on this basis, Doederlein considered that in 53·3 per cent. the secretion was normal, in 44·6 per cent. abnormal. Whitridge Williams,† in 1893, published the results of an examination of fifteen cases, results which in the main agreed with Doederlein. The practical outcome of Doederlein's work was to point to the possibility of auto-infection, and hence to the necessity for prophylactic vaginal douches.

In 1894, Kroenig, who had succeeded Doederlein at Leipzig, published the result of his examination of 100 cases,‡ results which were directly opposed to those of Doederlein. Kroenig stated that 'the vaginal secretion of pregnant women who had not been examined, no matter whether normal, pathological, or highly pathological, never contained organisms which grow aerobically upon the ordinary media at the body temperature, except yeast and gonococci, and therefore never contained septic bacteria. The vagina of every pregnant woman who has not been examined is therefore aseptic.' Later in the same year, Kroenig published another article on the effect of the vaginal secretion on bacteria.* In this, he stated that the secretion, no matter what its character, possessed a markedly bactericidal action upon pathological organisms; and 'that we may consider the vagina of a pregnant woman as aseptic if we are sure that two or three days have elapsed since she was examined.' This bactericidal action was found to be more marked the nearer to the cervix the test-growth was placed, and to be weakened or destroyed by antiseptic douches. It had been already described by Doederlein,† who attributed it to the acidity of the vaginal discharge, caused by the presence of the vaginal, or lactic acid, bacillus. Kroenig further attributed this effect to phagocytic action and lack of oxygen.

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* 'Das Scheidensekret,' Leipzig, 1892.

† 'Puerperal Infection considered from a Bacteriological Point of View,' *American Journal of Medical Sciences*, July, 1893.

‡ 'Scheidensekretuntersuchungen bei 100 Schwangeren. Aseptik in der Geburtshülfe,' *Centralb. f. Gyn.*, 1894, 3-10.

Kroenig did not stand alone in his opinions. The same year that he published the article which has been referred to, Menge also published the results of the examination of fifty non-pregnant women,‡ in whom he had found the same bactericidal powers of the vaginal secretion, though they were not so marked as in pregnant women. In other ways he also confirmed Kroenig's work.

In 1897, Menge and Kroenig published jointly a work in which the results of the examination of sixty-seven additional cases was recorded.§ From the united results of these and of the former cases, they confirmed their previous statement as to the absence of pyogenic organisms from the vaginal secretion.

The differences between the results obtained by Menge and Kroenig, and by Doederlein, Whitridge Williams, and others, were stated by Kroenig to be due to faulty technique, whereby the septic organisms on the vulva were carried up into the vagina in the course of the removal of a specimen of the secretion for examination. With a view to either proving or disproving this, Williams undertook a fresh series of examinations on ninety-two women, with a technique which rendered the possibility of contamination of the vaginal secretion very small. The results of this examination are embodied in a most interesting article,‖ which was read before the American Gynæcological Society, and to which we are indebted for much information relating to the work of previous investigators. Williams' work gives almost unqualified support to Kroenig's statements in the matter of septic organisms. In only two cases could he find cocci in the secretion, and these cocci were not such as are found in puerperal infection. On the other hand, he found several forms of aerobic bacilli as follows:—

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* 'Ueber das bakterienfeindliche Verhalten des Scheidensekretes Schwangeren,' *Deutsche Med. Wochenschrift*, 1894, No. 43.

† *Op. cit.*

‡ 'Ueber ein bakterienfeindliches Verhalten der Scheidensekrete Nichtschwangerer,' *Deutsche Med. Wochenschrift*, 1894, Nos. 46-48.

§ 'Bakteriologie des Weiblichen Genitalkanales.' Leipzig, 1897.

‖ 'The Bacteria of the Vagina,' *Transactions of the American Gynæcological Society*, 1898, p. 141.

(1) The vaginal bacillus in 30·4 per cent. of the cases.

(2) Long, thick bacilli, resembling the vaginal bacillus, in 17·4 per cent. of the cases.

(3) Short, thick bacilli in about 12 per cent. of the cases.

(4) Gas-producing bacilli in 3·2 per cent. of the cases.

Also various forms of anaerobic bacilli were found in about 16 to 17 per cent. of the cases, and included one form of gas-producing bacillus. None of these bacilli—aerobic or anaerobic—appeared to possess any pathogenicity.

Williams further endeavoured to divide his cases into those with normal and those with abnormal secretion, according to the criteria of Doederlein, but apparently without any practical result. He did not find that the characteristics which Doederlein described were in all cases a correct index of the bacterial contents of the secretion. Moreover, his tables showing the relative course of the puerperium in the cases of so-called normal and abnormal secretion do not definitely show that there was any causal relationship between 'abnormal secretion' and subsequent elevation of temperature.

The conclusions which are drawn by Williams from his own examinations are as follows:—

(1) The vaginal secretion of pregnant women does not contain the usual pyogenic cocci.

(2) The discrepancy in the results of previous investigators was due to the manner in which the secretion was obtained.

(3) As the vagina does not contain pyogenic cocci, auto-infection is impossible. Consequently, when such cocci are found in the uterus, they have been introduced from without.

(4) The gonococcus is occasionally found in the vaginal secretion, and during the puerperium may extend from the cervix into the uterus and tubes.

(5) It is possible that, in rare instances, the vagina may contain bacteria which give rise to sapræmia and putrefactive endometritis by auto-infection. If such cases occur, they are usually not severe, and do not cause death.

(6) Death from puerperal infection is always due to infection from without, and is usually due to the neglect of aseptic precautions on the part of the physician or nurse.

(7) Puerperal infection is to be avoided by limiting vaginal examinations as much as possible and by cultivating abdominal palpation. When vaginal examinations are to be made, the external genitals should be carefully cleansed and the hands rendered as aseptic as for a surgical operation. Vaginal douches are not necessary, and are probably harmful.

These conclusions represent very fairly the extent of our knowledge of the bacteriology of the vagina. They may be summed up in a few words:—The healthy vagina is an aseptic canal, and prophylactic vaginal douches are consequently not necessary.

We have quoted Kroenig as stating that even the pathological or highly pathological secretion of pregnant women never contained septic bacteria. This statement must, however, surely be qualified. Doubtless his experiments tend to show that, so long as the influence of the vaginal bacillus and the other causes of vaginal asepsis were paramount, septic organisms rapidly disappeared, but, on the other hand, he advances no proof that the action of the vaginal bacillus cannot be overcome by excessive numbers of pyogenic cocci, a result which is bound to occur in certain cases. Where septic abscesses drain into the vagina, or where septic vaginitis or other septic conditions of the vaginal walls is present, the vagina must contain septic organisms so soon as the strength of the invading bacteria overcomes the resistance of the vaginal bacillus.

3 **The Uterine and Cervical Cavities.**—The bacteriology of the uterine and cervical cavities is perhaps more settled than is that of the vagina. Winter examined a number of healthy uteri, and came to the following conclusions:—*

(1) The healthy uterine cavity contains no bacteria. - is [illegible]

(2) The vicinity of the os internum contains no bacteria in 50 per cent. of cases.

(3) The cervical secretion of every healthy woman contains numerous bacteria.

This view has been adopted for some time, and has led to the division of the plug of mucus—the operculum, which fills the cervical cavity—into three zones: an upper sterile zone; a middle bactericidal zone; and a lower germ-containing zone. We shall see presently to what the bactericidal action of the middle zone is due. Menge and Stroganoff,† on the other hand, considered that the dividing line between germ-containing and germ-free territories lay at the os externum. They agreed as to the bactericidal action of the cervical mucus. Between these two views there is no very essential difference, as they both recognise that the uterine cavity is germ free, and only differ in the exact situation of the dividing line between the germ-free and the germ-containing territories.

The cause of the sterile condition of the uterine cavity is, as we have mentioned, in the main the bactericidal action of the operculum, or plug of mucus which fills the cervical canal. Japp Sinclair‡ particularises the various causes of this action as follows:—

(1) The difference in the reaction of the cervical and the vaginal secretions—a difference which keeps away from the cervix the facultative aerobes and pathological organisms which sometimes gain a footing in the vagina.

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* 'Ueber der Bakteriengehalt der Cervix,' *Centralb. f. Gyn.*, 1895, 508.

† 'Bakteriologische Untersuchungen des Genitalkanales beim Weibe in Verschieden Perioden ihres Lebens,' *Monatss. f. Geb. u. Gyn.*, 1895, ii. 365-394 and 494-504.

‡ 'A Text-book of Gynæcology,' edited by C. A. L. Reed, p. 355.

(2) The muscular power of the walls of the cervical canal.

(3) The downward stream of the cervical secretion.

(4) Some germicidal quality in the cervical secretion—that is, in the leucocytes and in the fluid which constitute the operculum.

(5) The presence of the gonococcus when it has gained access to the cervix. It is thought that the presence of the gonococcus has a deterrent effect on the development of other bacteria. This factor is, however, obviously of no account in healthy uteri.

The foregoing brief account of the bacteriology of the genital passages can be summarised as follows:—The genital passages may be divided into three tracts or zones—(*a*) a septic tract, comprising all outside the hymen; (*b*) an aseptic tract, comprising the vagina; (*c*) a sterile tract, comprising the uterine and cervical cavities.

The cause of the condition of (*a*) requires no explanation. The aseptic condition of (*b*) is due to the deterrent action of the vaginal or lactic acid bacillus on pyogenic organisms. The sterile condition of (*c*) is due to the bactericidal action of the constituents of the operculum.

After labour, the bacterial conditions of the genital passages have markedly changed. Instead of there being three tracts or zones, as have been described, there are but two—a septic tract, comprising, as before, the vulva, and adjacent parts; and a sterile tract, comprising the vaginal and uterine cavities. In other words, the vagina has been changed from a tract which, though aseptic, contained numerous non-pathogenetic bacteria, and possibly some facultative saprophytes to a sterile tract. This change is in all probability brought about mechanically. When the membranes rupture, the downward flow of liquor amnii sweeps away much of the vaginal mucus and of its bacterial inhabitants. As the head descends, it dilates the vaginal walls to their utmost extent, and consequently enables the second flow of liquor amnii to more thoroughly sweep out the vaginal contents. Lastly, the birth of the placenta completes the cleansing of the vagina.

If any further argument is necessary to destroy that bugbear of obstetrics, the possibility of true auto-infection—*i.e.*, infection from bacteria which are present in the genital passages under normal conditions, such proof is to be found in the statistics of the large maternity hospitals, which have abolished the use of the prophylactic douche in normal cases. We cannot here enter into these statistics. It is sufficient to say they furnish a striking clinical proof of the truth of Kroenig's and Williams' statements regarding the asepsis of the normal vagina.

We may, then, safely assume that neither before nor after labour is auto-infection possible. If the patient is infected, the cause of the infection has come from without, either directly or indirectly from some already infected area. Already existing septic infection may be present in the form of septic or gonorrhœal vulvitis, urethritis, vaginitis or cervicitis, as peri-vaginal or peri-uterine abscesses, as septically infected chancres or condylomata, or, in short, as any form of septic lesion which communicates directly or indirectly with the genital passages. Septic infection from without can be introduced in three ways—by septic hands, by septic instruments, and by carrying up septic matter from the vagina and perinæum.

The prevention of the extension of infection in already infected cases will be discussed in its proper place under the treatment of septic infection. Here, we are alone concerned with the preservation of asepsis—*i.e.*, with the prevention of the infection of previously healthy patients.

THE PREVENTION OF SEPSIS

In order to prevent the occurrence of septic infection, the obstetrician must determinedly set himself to ensure the surgical cleanliness, or, if possible, the asepsis, of everything which comes into contact with the genital passages of the patient. Asepsis can only be obtained in the case of substances which can be submitted to the prolonged action of a sufficient degree of heat or of antiseptics of sufficient strength to ensure the destruction of all bacteria. This can be done in the case of instruments and dressings, but in the case of the genital passages themselves, or of the hands of the operator, sterility is unattainable, and the obstetrician, like the surgeon, must be content with surgical cleanliness.

The Disinfection of the Hands.— The hands of the obstetrician furnish the most common means by which septic infection is introduced. Vaginal examinations have to be made, operations have to be performed, and in both these procedures the fingers are in intimate relation with what may be termed inocculable areas. Consequently, the cleansing and disinfection of the hands is of pre-eminent importance.

Many methods of obtaining surgical cleanliness have from time to time been recommended, and as a rule in surgical practice every surgeon has his own favourite method. The range of choice in obstetrical practice is, however, more limited, as, although in hospitals methods which involve many details can be readily carried out, in general practice complicated processes are impossible. This, however, is not altogether without its advantages. The adoption of complicated processes of disinfecting the hands sometimes tend to make an operator or an obstetrician attach too much importance to the use of various kinds of chemical antiseptics, to the neglect of that most important of antiseptics, soap and water. The use of chemical antiseptics is undoubtedy a proper and necessary procedure when they are used in a sensible manner; but this, unfortunately, is not always done. Medical men who are not familiar with the properties of antiseptics are sometimes inclined to neglect them altogether, or, on the other hand, to attribute what is little short of miraculous powers to them. All antiseptics require a certain time in which to produce their effect, and few, if any, antiseptics will act on bacteria which are protected by a covering of grease. Consequently, if we desire to disinfect our hands by the use of chemical antiseptics solely, we must first soak the hands in some substance which will dissolve away all fat, and then expose them for the necessary time to the action of the antiseptic chosen. Such a process cannot always be adopted by men in general practice, and we therefore do not recommend it. We have only mentioned it to show that splashing a finger or even a whole hand through an antiseptic, and then considering that the finger is in a fit condition to insert into the vagina, is a practice akin to the hereditary folly of the ostrich.

The following is a satisfactory method of disinfecting the hands, it possesses the advantage of not requiring the use of several different kinds of antiseptics, and it has stood the test of time at the Rotunda Hospital and in many other places. It is carried out as follows:—Cut the nails short, and remove gently with a penknife any superfluous skin which may surround them. Wash the hands with any good soap—carbolic, if wished—and a nail-brush for from three to five minutes, in plain water or in a one per cent. solution of lysol. Special attention must be paid to the nails and the skin surrounding them. Wash off all trace of soap from the hands, and then immerse them for one minute in a 1 in 500 solution of corrosive sublimate in water. If the obstetrician does not like corrosive sublimate, he can substitute for it mercuric potassium iodide, a substance which has the advantage over corrosive sublimate that it does not cause blackening of the finger-nails. It is also said to be more powerful and at the same time to possess less toxic effects, and so to be less dangerous. It possesses the properties of the red iodide of mercury, but is considerably more soluble. It is used at a strength of 1 in 1,000.

In hospital practice or after contact with pus or other septic material a more rigorous method of disinfection may be adopted. Reinicke* states that absolute sterility is *almost* obtained by the following process:—Scrub the hands for five minutes in warm water with soap and a nail-brush. Then scrub them for from three to five minutes in absolute alcohol, and finally soak them in an antiseptic such as corrosive sublimate. Kelly,† on the other hand, recommends the use of permanganate of potash and oxalic acid. His procedure is as follows:—First, scrub the hands and forearms for ten minutes with soap, warm water, and a nail-brush. The water must be frequently changed. Then, immerse the hands in a hot, saturated solution of permanganate of potash until they are stained a deep mahogany colour. Next, immerse them in a saturated solution of oxalic acid, which removes the colour and completes the sterilisation. The oxalic acid should be as warm as possible. Lastly, remove the oxalic acid by rinsing the hands in warm water or in sterilised lime-water.

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* *Centralb. für Gyn.*, November, 1894.

† 'Operative Gynæcology,' vol. i., p. 22.

The introduction of rubber gloves, which can be boiled, is of great advantage to the obstetrician, as they enable him to render his hands aseptic at a moment's notice. If thin gloves are used the operator's sense of touch is little, if at all, impaired. The gloves must be boiled before use, and will be most readily drawn on if they are first filled with a weak solution of lysol. Their use by the general practitioner who is obliged to attend all kinds of cases is absolutely indicated both when making vaginal examinations and when performing obstetrical operations.

A few words must be said with regard to the use of lubricants. We hope that it is unnecessary at the present day to point out the dangers of the use of vaseline taken from a large open ointment-jar, into which clean and dirty fingers have been dipped from time to time. As a general rule, lubricants are unnecessary during labour, as the abundant mucus in the vagina acts as a natural lubricant. In some cases it is, however, of material service to have the fingers lubricated with some aseptic substance. For this purpose, soap answers as well as anything else. If it has been boiled in the making, and if the outer coat is first washed off, we may rely on its asepticity. Antiseptic lubricants, which can be obtained in collapsible tubes, such as corrosive vaseline, may also be used, if care is taken to replace the metal cap of the tube after using. If lysol solution is used with which to wash the hands a lubricant is not required, as the soap which it contains is sufficient. It is for this reason a typical antiseptic for midwifery practice, but it is also well to have a basin containing corrosive sublimate at hand, as the slipperiness which lysol imparts to the hands is at times a disadvantage.

Sterilisation of Instruments and Dressings.—Instruments which can be boiled without deterioration admit of ready sterilisation in this manner. They should first be taken asunder as far as possible, then scrubbed with soap and water and a brush, and lastly boiled for at least five minutes in a one per cent. solution of common washing soda. The latter is said to prevent them from rusting, and is at any rate a good solvent of grease. To permit of this method of sterilisation all instruments should when possible be made of metal, and wooden handles have rightly fallen into disuse, as it is impossible to effectively sterilise them. Dressings, when required in operative cases, must be sterilised in the usual manner in a steam steriliser. Sanitary towels or diapers required after delivery should be placed in a 1 in 500 solution of corrosive sublimate at the commencement of labour. They will then be ready for use when required.

Laminaria tents are occasionally wanted in obstetrical practice. They must never be used unless they have been previously thoroughly sterilised. This is done by soaking them for twenty-four hours in ether and then storing them in a one per cent. solution of corrosive sublimate in alcohol, or they may be boiled in alcohol for twenty minutes in the author's catgut steriliser.

The Disinfection of the Genital Passages.—The external genitals must be disinfected with the greatest care at the commencement of labour, as otherwise, as we have mentioned, septic organisms may be carried into the vagina, and so the care and trouble which has been taken to ensure the disinfection of the hands be rendered useless. Similarly, during the course of labour, the parts must be disinfected afresh whenever any soiling occurs. To disinfect the genitals at the commencement of labour, first wash the parts carefully with the hand and soap and water or a half per cent. lysol solution, taking care to separate the labia and to wash between them. Then, wash off the soap, and bathe the parts well with a 1 in 500 solution of corrosive sublimate. For subsequent disinfection, use lysol solution, as the continued use of corrosive sublimate is prone to produce a rigid condition of the perinæum, and so to tend to the occurrence of lacerations. If it is necessary to pass the catheter, care must be taken to thoroughly cleanse the orifice of the urethra.

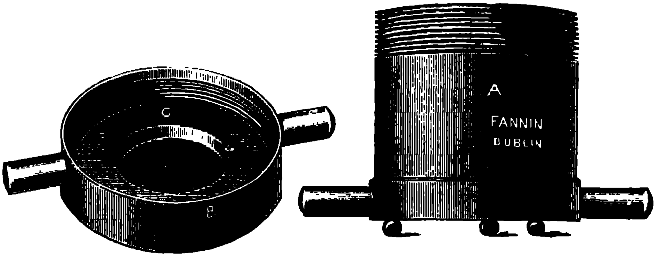

FIG. 101.—THE AUTHOR'S CATGUT STERILISER.
A, Receptacle for catgut; B, screw cover; C, rubber washer.

We must now discuss an important question on which we have already touched when discussing the bacteriology of the genital tract. Is it necessary to wash out the vagina during labour in all cases? In other words, is a prophylactic douche—*i.e.*, a douche given with the object of preventing septic or saprophytic infection—necessary either before or after labour? This practice has been in the past and, indeed, is still adopted by many competent authorities. It is, however, an operation—for it is right to consider it such—to which a very definite risk is attached, the risk of introducing instead of removing septic organisms. Consequently, it is a practice which should not be adopted unless it can be clearly shown that the danger of omitting it is greater than the danger of adopting it. The study of the bacteriology of the vagina has shown, and clinical facts have clearly demonstrated, that this is not so. When a vaginal douche is regarded as a preliminary essential to operation, and as a procedure which must be carried out thoroughly and carefully, the attendant risk of introducing septic organisms is minimised. But, when the administration of a vaginal douche is regarded as a matter of routine—which must be done in every case, and of the efficacy of which there is considerable doubt, and especially when it is entrusted to a more or less competent nurse-tender to carry out, the possibility of the infection of the patient is very much increased.

We may answer definitely in a few words the question which we have asked. The use of a routine vaginal douche in normal cases is not only unnecessary, but dangerous. It is a practice which cannot be too strongly condemned, and which, we trust, will rapidly fall into the same oblivion in private practice into which it has already fallen in well-conducted maternity hospitals.

When any operation has to be performed which necessitates the passing of the hand or of instruments into the uterine cavity the cleansing of the external genitals must be still more carefully performed. In such cases the obstetrician must not trust to the nurse, but perform this duty himself as an immediate preliminary to the operation. In addition to the external disinfection, it is also well to thoroughly wash out the vagina, with the object of removing all discharge, blood-clots, etc., which may have collected there. The necessity for this may be questioned, in view of what we know of the bacteriology of the vagina. The answer is shortly this:—The vaginal discharge may contain facultative saprophytes, or even actual saprophytes which have gained access in the air. If these are carried into the uterus, and there find a suitable nidus, sapræmic infection will result. This is particularly likely to occur in cases of the application of the forceps when labour has been prolonged. In these cases, the liquor amnii lies, possibly for many hours, in the vagina, and decomposes under the influence of air-borne saprophytes. Consequently, a preliminary douche is advisable. Further, in normal cases, all movement through the vagina is in a downward direction, and so tends to prevent the upward passage of micro-organisms. When, however, the hands or instruments are passed upwards into the uterus the reverse is the case, and any decomposing material in the vagina is directly carried upwards.

The most suitable fluid with which to douche out the vagina or uterus is in all probability sterilised water, if it can be obtained. It is very improbable that antiseptic solutions have any direct germicidal effect on bacteria which may be present, inasmuch as bacteria are not exposed to their action for a sufficient period to be destroyed by the weak solution which we are compelled to use. Vaginal douches in all probability produce vaginal asepsis, not by killing the bacteria present, but by sweeping them away mechanically in the stream of water. However, in private practice it is seldom or never possible to obtain sterilised water, and, consequently, we must use the next best substitute, which will be furnished by water to which an antiseptic has been added with the object of sterilising it. For general use, a one per cent. solution of lysol, or a 1 in 320 (*i.e.*, ½ oz. to a gallon) solution of creolin is perhaps the most suitable. Lysol possesses the undoubted advantage of containing a quantity of soap which increases its cleansing action, and which by its lubricating quality facilitates any intravaginal or intra-uterine manipulations. On the other hand, lysol is apt to cause unpleasant irritation of the skin and mucous membrane of the patient. If creolin is used, the necessary quantity must be first added to cold water, and then boiling water added to this, as it does not mix well with hot water.

The use of corrosive sublimate solution for douching purposes is not to be recommended. In the first place, even in very weak solution it is occasionally attended with unpleasant consequences, as it affects different patients in different degrees of severity. Fatal consequences have followed the injection of a quart of corrosive sublimate solution of a strength of 1 in 1,000.* Its use is especially dangerous in the case of patients suffering from Bright's disease or in those who have had attacks of hæmorrhage, or who have extensive laceration of the vagina (Ribemont-Dessaignes). Further, it is unreliable as an antiseptic, as it is decomposed by albumin forming an insoluble albuminate of mercury, and, if this decomposition is prevented by the addition of tartaric acid, as is usually the case, the toxic effect of the douche is increased. Also, corrosive sublimate has the unpleasant property of constringing the tissues with which it comes into contact, and so increasing their rigidity and liability to laceration during labour. If, for any reason, corrosive sublimate is used for douching purposes, a solution of 1 in 5,000 is of sufficient strength, and such a solution is said to have the same bactericidal effect as has a solution of 1 in 1,000 (Tarnier).

Carbolic acid is also unsuitable for use, as its toxicity is greater in comparison to its germicidal power than is the toxicity of either creolin or lysol. It also occasionally causes an erythematous eruption of the skin and mucous membrane with which it comes in contact. If it is used, the strength of the solution should not exceed two per cent.

A vaginal douche is administered as follows:—The patient is placed on the left side, with her buttocks projecting well over the edge of the bed. Beneath her, is placed a small mackintosh of sufficient size to extend beyond her into the bed, where it ought to pass over a pillow or a folded sheet, in order to prevent the water from running in the wrong direction, while it hangs over the edge of the bed as a valance, and so serves to conduct the water into a bath placed to catch it. The douching-fluid is placed in a jug or douche-can, from which it can be drawn by a syphon-douche in the manner subsequently described, and which is placed at the necessary height. The external genitals are first thoroughly washed and disinfected. A glass nozzle, with several apertures at the end for the escape of the fluid, is then fixed to the end of the tube; the doctor or nurse, as the case may be, stands or, better, sits on a low stool beside the patient, and holding the nozzle in the right hand, passes two fingers of the left hand into the vagina, and draws back the perinæum. The nozzle is then introduced, and passed at once to the top of the vagina, in order that the stream may flow downwards through the vagina, and not upwards. While the fluid flows, the fingers distend the vaginal walls, in order to ensure that no folds exist in which discharge can remain. The usual amount of fluid which is used is about half a gallon.

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* 'Death from a Single Vaginal Douche,' by G. de N. Hough, *Boston Med. and Surg. Journ.*, April 9, 1903, p. 393.

If a uterine douche is to be administered, it is preferable to place the patient in the cross-bed position, her buttocks projecting over the edge of the bed and the mackintosh arranged as before. A vaginal douche is given in the manner described, and then the glass nozzle is removed and a Bozemann's return catheter substituted. Under the guidance of the fingers, the catheter is introduced into the uterus, and passed cautiously upwards as far as it will go. The tip of the catheter is moved gently from side to side in order to wash out the entire cavity. If the return pipe becomes blocked by a clot or débris, the catheter must be at once removed and the pipe cleared.

CHAPTER II

THE OBSTETRICAL ARMAMENTARIUM

Antiseptics—Drugs—Instruments, for General Use, for Special Operations—Contents of the Obstetrical Bag.

THE armamentarium of the obstetrician should be as uncomplicated and as small as is consistent with the requirements of modern obstetrics, inasmuch as portability is a most necessary quality. At the same time, it must also be complete. An obstetrician has frequently to attend patients at a considerable distance from his residence, and, as some obstetrical complications are sudden in their occurrence and urgent in their demand for treatment, it is never safe to rely on the possibility of sending for the necessary instruments or drugs when they are required. They must rather be always at hand, or otherwise valuable time may be wasted and perhaps life lost. In the following chapter we propose to enumerate the various components of an obstetrician's armamentarium, mentioning the instruments and drugs which should be always at hand during the conduction of a case, as well as those which may occasionally be required, but which it is not necessary to have always within immediate reach.

ANTISEPTICS.—As we have seen in the previous chapter, antiseptics are required for the disinfection of the hands of the obstetrician and the skin of the patient, and for use in vaginal and uterine douches. For these purposes, two antiseptics are sufficient—1 corrosive sublimate and 2 lysol or creolin. Corrosive sublimate is most readily carried in the form of tablets, one of which added to a pint of water makes a solution of the strength of 1 in 1,000. The other two antiseptics are carried in their full strength.

In certain septic conditions of the genital tract, it may be necessary to use some antiseptic in a form which will enable it to be brought into prolonged contact with the septic area. This is particularly the case in puerperal ulcers, septic endometritis, and such conditions. 3 The most useful antiseptic for this purpose is iodoform, a substance which can be introduced into the genital passages as a powder, in the form of a pencil or bougie, or on gauze. The powder can be carried in a small dusting-pot with a screw cover, to prevent the escape of the iodoform or the entrance of dirt. Iodoform bougies are but rarely required, as their place has been largely taken by iodoform gauze. The author does not recommend their use. If required, they can be carried in a sterilised bottle with a closely-fitting stopper. Iodoform gauze, on the other hand, is a most valuable substance, and furnishes an excellent method of obtaining the germicidal action of iodoform. It is used not alone for disinfecting septic surfaces, but also for plugging the vagina and uterus in cases of hæmorrhage, etc., as in such cases the use of aseptic gauze is inadvisable on account of the danger of saprophytic decomposition. The form of gauze most suited for obstetrical work is known as moist gauze, and contains about ten per cent. of iodoform. It is usually packed in boxes or jars containing six yards. These pieces are too wide for tamponing purposes, and should be cut into strips of two or three inches in width. These are then rolled as a bandage, and are ready for use when required. Considerable doubt has been expressed as to the germicidal power of iodoform, as, experimentally, it appears to have little or no effect on staphylococci or streptococci in culture-tubes There is, however, little doubt that, practically, as applied to wounds, iodoform has a considerable germicidal effect, or, at any rate, a considerable power of preventing the effects of germ infection. This difference in its behaviour is accounted for on the ground that iodoform, to develop its germicidal effect, requires to be in the presence of albumin. It is also said that iodoform does not so much destroy bacteria as transform their toxins into combinations with iodine which are non-toxic (Stchégoleff).* Whatever may be its actual mode of action, the beneficial effect of iodoform in suppurative or sapræmic conditions is undeniable.

DRUGS.—The drugs which must be carried by an obstetrician are few in number, and only include such as are of routine use or are liable to be required in an emergency. The following list will as a rule be found to be sufficient:—

(1) *Ergot.*—This may be carried either as the liquid extract, for administration by the mouth or hypodermically, or as citrate of ergotinin for hypodermic administration. The pharmacopœial dose of the former preparation is ten to thirty minims by the mouth, and is valueless for obstetrical purposes—*i.e.*, as an oxytoccic or promoter of uterine contractions. For this purpose, up to two drachms may be given by the mouth, and up to half a drachm hypodermically. The pharmacopœial preparation is notoriously unreliable, but the preparation known as Squibb's liquid extract of ergot may be regarded as trustworthy if it has not been kept for too long. Up to $\frac{1}{25}$ grain of the citrate of ergotinin may be given hypodermically.

* *Arch. de Méd. Expériment.*, November, 1894.

(2) *Chloroform.*—This is required for inducing anæsthesia. A four-ounce drop-bottle should be carried.

(3) *Strychnine.*—This may be required in cases of syncope from hæmorrhage or other cause. It is most easily carried as the sulphate of strychnine, made up in tablets for hypodermic administration, and containing $\frac{1}{100}$ grain. Up to $\frac{1}{20}$ grain may be administered at a time.

(4) *Ether.*—This may also be required in cases of syncope. It is administered hypodermically in doses of twenty to forty minims. An ounce or so of it should be carried in a stoppered bottle.

(5) *Tincture of Opium and Morphia.*—Both these drugs should be carried, as they are constantly required for their sedative or hypnotic effect, and morphia may also be required in cases of eclampsia. An ounce of the former in a stoppered bottle and tablets containing a third of a grain of the latter for hypodermic administration, are the easiest method of carrying them.

The foregoing are the only drugs which should be habitually carried. Any others can be obtained specially if they are wanted.

INSTRUMENTS.—In discussing the various instruments which are required by the obstetrician we propose to divide them into two classes:—

(A) Instruments which are required for general obstetrical purposes or whose use is common to the majority of operations.

(B) Instruments which are required for the performance of special operations.

(A) **General Instruments.**—The instruments or appliances which are required for general purposes or whose use is common to the majority of operations are as follows:—

(1) *A Syphon Douche.*—This appliance is designed to take the place in private practice of the douche-tin, which is more generally used in hospitals. It is a portable, easily-cleaned, and most efficient means of administering a vaginal or uterine douche, and has, we trust, entirely supplanted that dangerous and inefficient implement, a Higginson's enema syringe. The construction of a syphon douche will be readily understood from the illustration (*v.* Fig. 102). It is composed of a rubber tube about six feet in length, without valves of any kind. At one end, it has got a sinker, which keeps it immersed in the fluid used; a little further up the tube is encased in a movable horseshoe-shaped guard of vulcanite, which fits over the edge of the jug and prevents the tube from kinking. Halfway down the tube, there is a ball-shaped expansion, and a little further on there may or may not be a tap. It is completed at the other end by a glass nozzle. To use the douche, the sinker is immersed in the fluid, and the vulcanite guard adapted to the depth of the jug, which is then placed upon the stand. The ball is compressed with one hand, and the tube then nipped between the nozzle and the ball. By this

means, when the ball is released, water is drawn into it from the jug. This usually is sufficient, and the water will continue to run, upon the principle of a syphon. If it does not, it is only necessary to repeat the previous manipulation.

Its advantages over a Higginson's syringe are at once apparent. The latter has got two valves, which are seldom perfectly efficient. The result is that there is usually a slight amount of indraw through the nozzle, and consequently vaginal discharge, etc., tends to find its way into the ball, with the result that the difficulty of keeping it sterile is very great. Further, the flow of water from it is intermittent, and it requires the use of both hands, one holding the nozzle in position, the other compressing the ball. Lastly, the fact that an enema syringe is primarily intended, and is used for the administration of enemata, renders it probable that a single syringe will be used for both the rectum and the vagina—a most dangerous practice. A syphon douche can be sterilised by allowing it to soak for some hours in a 1 in 500 solution of corrosive sublimate, if the metal sinker and the tap are first removed. It should then be carried in a sterilised waterproof bag.

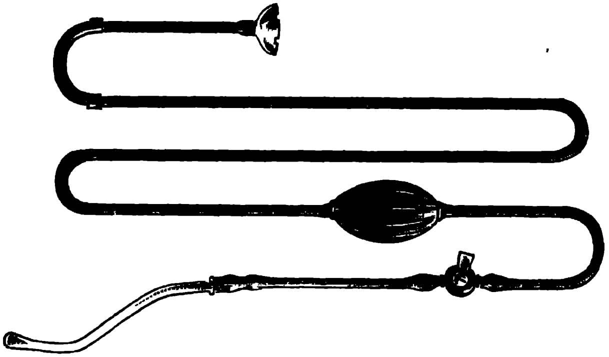

FIG. 102.—A SYPHON DOUCHE.

(2) *An Enema Syringe.*—This may be occasionally required for the administration of enemata, and must not be used for any other purpose. Higginson's syringe is the form which is generally used. It should be carried in a small bag, to prevent it from coming into contact with other instruments.

(3) *A Female Catheter.*—A metal catheter of the form shown is the most serviceable. It is readily sterilised by boiling, and cannot be broken. The percentage of cases in which it is necessary to empty the bladder, and in which such a catheter cannot be introduced, is extremely small, and for such cases a new gum-elastic catheter may be carried, but as it cannot be easily sterilised, it must not be used a second time.

(4) *Vaginal and Uterine Douche Tubes.*—A glass nozzle six inches in length and pierced at the top with several holes is the best form of tube for vaginal douching. It can be sterilised by boiling. Two or three should be carried, as they are liable to get broken. For uterine douching, a return catheter is necessary—that is, one which not only carries the water into the uterine cavity, but also provides a means for the escape of the fluid. The best form is, perhaps, that devised by Bozemann. It is made of metal, and can be taken apart for cleansing purposes. Two sizes should be carried. A large size for post-partum douching, and a smaller size for use in cases of abortion, etc.

(5) *A Hypodermic Syringe.*—One of the numerous forms which permit of sterilisation should be used.

(6) *A Mucus Aspirator.*—This is required for removing mucus from the throat of the infant, in cases where premature efforts at inspiration have been made. Ribemont-Dessaignes devised a special instrument for this purpose, composed of a tube with a curve corresponding to the respiratory passages, and through which suction is obtained by the attachment of a rubber bag similar to that of a ball enema syringe or by the mouth of the operator applied directly.* A male metal No. 3 catheter answers the same purpose, and is more generally used.

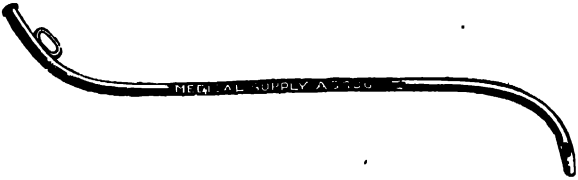

FIG. 103.—FEMALE CATHETER.

(7) *A Pair of Surgical Scissors.*

(8) *A Good Nail-Brush.*

(9) *Chloroform Inhalers.*—It is usually advisable to carry two forms of chloroform inhaler, one for obtaining obstetrical, and the other for obtaining surgical anæsthesia. For the first purpose, Murphy's inhaler is best. It will be subsequently described. For the second purpose, Schimmelbusch's mask or other similar form of mask is most suitable.

(B) **Special Instruments.**—The instruments or appliances which are required for the performance of special operations are as follows:—

(1) *The Induction of Labour and Dilatation or Incision of the Cervix.*—(*a*) Gum-elastic bougies; (*b*) Champetier de Ribes' or Barnes' hydrostatic dilators, or sea-tangle tents; (*c*) Hegar's dilators;

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* 'Recherches sur l'insufflation des nouveau-nés et description d'un nouveau tube laryngien,' *Progrès Médical*, 1878.

(*d*) American forceps; (*e*) long-handled and blunt-pointed scissors (*f*) vaginal speculum; (*g*) appliances for suturing as below.

(2) *The Application of Forceps.*—A pair of long axis-traction forceps—Neville's, Milne Murray's, or Tarnier's.

(3) *Extraction in Obstructed Breech Cases.*—A porte-fillet or No. 10 gum-elastic catheter with stilette.

(4) *Craniotomy.*—(*a*) A perforator—Simpson's or Naegele's; (*b*) a cranioclast—Braun's; or better, a combined cranioclast and cephalotribe—Winter's modification of Auvard's.

(5) *Embryotomy.*—(*a*) Braun's blunt hook; (*b*) a pair of stout, long-handled and sharp-pointed scissors.

(6) Cœliotomy and Hysterectomy.—(a) Two scalpels; (b) a dozen clip-forceps; (c) three pairs of scissors, one sharp-pointed, one blunt-pointed, and one curved on the flat; (d) retractors; (e) four or five long, straight and curved, narrow-bladed clamp-forceps, and four or five stouter forceps of various shapes; (*f*) needles, needle-holders, and suture materials; (*g*) two short and two long dissecting forceps with sharp teeth; (*h*) three or four dozen gauze sponges.

(7) *Symphysiotomy.*—(*a*) Two scalpels; (*b*) two pairs of scissors; (*c*) two lateral retractors; (*d*) whole curved needles of different sizes; (*e*) needle-holder; (*f*) a dozen clip-forceps; (*g*) several straight and curved narrow-bladed clamps; (*h*) dissecting forceps with teeth; (*i*) suture materials; (*j*) iodoform gauze; (*k*) the usual sponges and dressings. In addition, the following, though not absolutely necessary, are often of great assistance: (*l*) A special knife for dividing the symphysis; (*m*) a bistoury with a short strong blade, thinner at the edges than in the middle; (*n*) Farabœuf's grooved sound; (*o*) a registering separator for separating and measuring the distance between the pubic bones.

(8) *Suture of Perinæal Lacerations, etc.*—(*a*) Needle-holder—Martin's or other form; (*b*) whole curved needles—Martin's; (*c*) sterilised silk, silkworm gut, or cat-gut.

(9) *Suture of Cervix.*—In addition to the foregoing—(*a*) posterior vaginal speculum; (*b*) two American forceps.

(10) *Tamponade of the Vagina and Uterus.*—(*a*) Iodoform gauze; (*b*) cotton-wool; (*c*) long narrow-bladed plugging forceps; (*d*) American forceps and posterior vaginal speculum.

(11) *Curetting.*—(*a*) Two or three curettes—Rheinstädter's, Sims', and Hegar's; (*b*) American forceps.

(12) *Infusion of Saline Solution.*—(*a*) A blunt-pointed metal nozzle for introduction into vein; (*b*) a sharp-pointed metal nozzle for introduction into cellular tissue.

IV. The foregoing is a fairly full list of the instruments and appliances which may be required to meet any obstetrical emergency. We must now select from amongst them those which should be habitually carried in the obstetrician's bag. They are as follows:—

(1) A syphon douche, two glass nozzles, and a large and small Bozemann's catheter.

(2) An enema syringe.

(3) A female metal catheter, a male No. 3 metal catheter, and a male No. 10 gum-elastic catheter.

(4) A pair of surgical scissors, and a pair of stout long-handled and blunt-pointed scissors.

(5) A good nail-brush.

(6) Murphy's chloroform inhaler, and any pattern of chloroform mask.

(7) An axis-traction forceps.

(8) Needles, needle-holder, silk, silkworm gut, and catgut.

(9) A blunt flushing curette.

(10) A sharp-pointed metal canula for intracellular infusion.

(11) Iodoform gauze and a plugging forceps.

All these instruments and appliances can, together with the necessary drugs and antiseptics which have been mentioned, be carried in an obstetrical bag of the usual size.

CHAPTER III

OBSTETRICAL DIAGNOSIS

Methods of Examination —I The History of the Patient —II Inspection — III Abdominal Palpation, the Diagnosis of Pregnancy, of the Presentation and Position of the Fœtus, of the Course of Labour, of the Presence of Complications; Different Grips—IV Vaginal Examination—V Auscultation; Maternal Sounds; Fœtal Sounds—VI Pelvimetry; External Measurements, Internal Measurements.

In the following chapter, we intend to discuss the various methods by which we can obtain the necessary information regarding the patient during pregnancy, labour, and the puerperium. We shall only discuss methods, and the information each one furnishes; the application of these methods to the diagnosis of obstetrical conditions will be discussed in another place.

The different methods of examining the patient are as follows:—

I. Questioning, with the object of eliciting her previous medical history and symptoms.
II. Inspection.
III. Abdominal palpation.
IV. Vaginal examination.
V. Auscultation.
VI. Pelvimetry.

THE HISTORY OF THE PATIENT

The information, which must be elicited regarding the history and symptoms of the patient differs, to some extent, according as we are dealing with a patient, during pregnancy or during labour.

During pregnancy the following information must be obtained:—

(1) Date of last menstruation; date of quickening; date at which the movements of the fœtus were last felt.
(2) Changes noticed in the size and appearance of abdomen and breasts.
(3) Condition of general health previous to pregnancy and during pregnancy.
(4) Number and nature of previous pregnancies, if any.
(5) Nature of previous labours. Are the children alive or dead? If dead, did they die prior to or during labour or after delivery, and what was the cause of death?

(6) Condition of urinary system. Amount of urine passed daily. Presence of any urinary trouble, such as too frequent micturition.
(7) Condition of digestive system. Presence of nausea, vomiting, loss of appetite, indigestion, constipation, diarrhœa.
(8) History of any organic disease.
(9) Presence of any abnormal condition of the genital organs—*e.g.*, vaginal discharge, pruritus vulvæ, prolapse of vagina, etc.

During labour answers to the following information must also be obtained:—

(1) When did the uterine contractions commence?
(2) Have the membranes ruptured? If so, how long?
(3) Is there any inclination to 'bear down'—*i.e.*, to exert the voluntary muscles of labour?

INSPECTION

A general inspection of the patient is made with the object of determining the presence of the usual appearances of pregnancy, of any obvious signs of ill-health, of abdominal tumours, or any marked deformity which could give rise to difficulties during labour.

The usual appearances of pregnancy are present to a varying degree in correspondence with the period of pregnancy, and are as follows:—

(1) The face:—Alterations in complexion and aspect.
(2) The breasts:—Alterations in size, shape, and appearance.
(3) The abdomen:—Alterations in size, shape, and appearance.
(4) The vulva and vagina:—Alterations in appearance.

The nature of these alterations will be dealt with later.

An obvious indication of ill-health is furnished by an appearance of undue emaciation or cachexia, or by the presence of anæmia, œdema, jaundice, or glandular enlargements.

The presence of abdominal tumours may be suggested by the enlargement of the abdomen out of proportion to the age of the pregnancy, and perhaps by the irregular and asymmetrical character of the enlargement.

The existence of marked pelvic deformity may be suggested by the following conditions:—

(1) Undue prominence of the abdomen, or a pendulous abdomen.
(2) Diminutive stature.
(3) Curvature of the spine—kyphosis, lordosis, or scoliosis.
(4) Crooked legs, legs of unequal length, or absence of one leg.

ABDOMINAL PALPATION

By abdominal palpation is meant the examination of the organs contained in the abdominal cavity by the hands applied directly to the abdominal walls. It is one of the most important methods of examining a pregnant or parturient woman, inasmuch as it furnishes information which can be obtained in no other way, and as it does so without causing any risk to the patient and with a minimum of discomfort. In both these respects, it compares very favourably with vaginal examination, which can never be entirely divested of danger, no matter how many precautions are taken, and which, moreover, often causes to the patient not only discomfort, but even actual pain. At all times, in the practice of obstetrics, we endeavour to replace internal manipulations by external manipulations, and, as we shall see, we can succeed in attaining this object to a very marked degree by the adoption of abdominal palpation instead of vaginal examination. Accordingly, a knowledge of the information which abdominal palpation will afford, and a sufficient degree of skill in carrying it out, are essential to the practice of obstetrics.

It is curious, that, in spite of the fact that the value of abdominal palpation has been recognised for close on a hundred years, it is only quite recently that the necessity for its practice has been insisted upon by obstetrical writers with any approach to unanimity, even though many of these writers have recognised the close connection between repeated vaginal examinations and the occurrence of septic infection. So far from abdominal palpation being a product of the closing years of the nineteenth century—as a perusal of the obstetrical literature of this country would lead one to suppose, directions as to the method of performing it, and particulars of the information which it might be expected to yield, were published by Wigand[*] in 1812, by Schmitt[†] in 1829, and by Hohl[‡] in 1834. Indeed, the last-mentioned author described the facts which can be ascertained by abdominal palpation as clearly and as fully as it is possible to do at the present day. In spite of these writings, however, abdominal palpation was not generally recognised to be of value until the last quarter of the nineteenth century, when Credé and Leopold in Germany, Pinard in France,[§] and Macan, Neville, and Smyly in Dublin, drew the attention of obstetricians to its immense practical importance. At the present day, its position in obstetrics is generally recognised, and the methods of performing it are universally taught in all large obstetrical clinics.

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[*] 'De la version par manœuvres externes et de l'extraction du fœtus par les pieds.'

[†] 'Gesammte obstetrische Schriften.' Wien, 1820-1828.

[‡] 'Die geburtschülfliche Exploration,' vol. ii., p. 144. 1834.

[§] 'Traité du palper abdominal, au point de vue obstétrical.' Paris, 1878

Accordingly, on account of the importance of the technique of abdominal palpation, we shall describe the method of performing it—

(1) With the object of diagnosing the existence of pregnancy.
(2) With the object of diagnosing the lie, presentation, and position of the fœtus.
(3) With the object of diagnosing the course of labour.
(4) With the object of diagnosing the presence of complications.

The Diagnosis of Pregnancy.—In performing abdominal palpation, the position of the patient is of great importance. She must be so placed that the examiner can sit at her right side on the couch and place his hands on the abdomen without any effort, and that her abdominal muscles are relaxed as much as possible. With these objects in view, she lies on her back, with the head slightly raised and supported by pillows, her arms extended along her sides, and her legs extended and slightly separated. Her garments and the bedclothes are so arranged that the abdomen is visible. The examiner then sits on the couch by the side of the patient, at the level of the middle of the femora, and facing her, and places both hands flat upon the abdomen, about the level of the umbilicus, care being first taken to ensure that the bladder is empty, and that the examiner's hands are warm. The finger-ends are then gently sunk into the abdomen with a view to determining the thickness and the tension of the abdominal wall, and the presence of any undue tenderness or pain on pressure. As soon as this has been done, the finger-ends are next sunk more deeply into the abdominal wall, with the object of determining the existence of any resistance such as would be caused by a tumour or an enlarged uterus. If no resistance is experienced at the level of the umbilicus, the hands are gently drawn downwards, and the contents of the false pelvis carefully ascertained. If there is still no resistance, the fingers are sunk as deeply as possible into the brim of the true pelvis. If, on the other hand, the fingers meet with resistance at the level of the umbilicus, they are gently pushed upwards, and the region between the umbilicus and the ensiform cartilage carefully examined, with the object of determining the upward limit of the resistance. Every movement must be made with gentleness and deliberation. Rough or sudden movements cause pain, and a consequent contraction of the abdominal muscles, and so effectually defeat their own object. When palpating the brim of the true pelvis, it is necessary to sink the tips of the fingers downwards as deeply as possible. In order to do this it is well to tell the patient to draw deep and regular inspirations, while at the same time gentle but firm pressure is made with the fingers of both hands. With each expiration it will be found that the finger-tips gain a little ground and penetrate more and more deeply towards the brim, until finally it is possible to reach any enlargement which has reached the level of the brim of the pelvis, or, in the case of thin patients, even one which lies below the brim.

As soon as the existence of such a resistance as would be caused by a pregnant uterus or a tumour has been experienced, the next point is to determine its nature. It may be caused by a pregnant uterus, a myomatous uterus, or an ovarian or other abdominal tumour. A pregnant uterus will be felt as a smooth, more or less globular, mass, medianly situated, and of a somewhat elastic consistency. If we keep the hands applied gently to its surface for a few moments, we shall in many cases be able to perceive that it alternately hardens and relaxes. And, further, if pregnancy is sufficiently advanced, we shall be able to determine the existence of a solid body floating inside it, and to appreciate the fact that this solid body moves. The fact that the uterus contains a movable solid body inside it is determined by a movement of the fingers, known as external ballottement (*ballotter*, to toss). This is performed by suddenly depressing the abdominal wall over a prominent part of the uterus with the finger-tips, and then keeping the fingers in position for a moment. The sudden pressure pushes away from the uterine wall the underlying part of the fœtus, which then floats back again into its former position, and as it does so taps gently against the fingers. Another method of obtaining external ballottement consists in laying both hands over the uterus, and then suddenly depressing the fingers of one. The fœtus is displaced by the pressure, and pushed over to the opposite side of the uterus, where it taps gently against the fingers of the other hand. In the middle months of pregnancy, the entire fœtus can be moved in the uterus in this manner. In the later months, however, it is only the head or perhaps a limb which can be made to move, as the pressure of the uterine wall controls the remainder of the fœtus.

2 **The Diagnosis of the Presentation and Position of the Fœtus.**—The method of performing abdominal palpation, with the object of diagnosing the lie, presentation, and position of the fœtus, differs somewhat from the method we have just described. The position in which the patient is placed is, however, similar. The examiner sits by the side of the patient at the level of the pelvis, and practises successively three grips, or methods of applying the hands. If further information is required, he turns in the opposite direction, so as to face her feet, and practises a fourth grip.

First Grip.—The first grip, or the fundal grip, is made as follows:—Both hands are placed over the upper part of the uterus, slightly to each side of the middle line, in such a position that the fingers roof over the fundus, then by gentle depression of the tips and by slight rotatory movements, the outlines of the portion of the fœtus which lies under the hands are determined. In almost every case, a round, resistant mass can be felt lying either in the middle line, or somewhat to one or other side under the arch of the ribs. This mass consists of one or other pole of the fœtus. To distinguish which pole it is, we must ascertain its mobility, its shape, its size, and its consistency. The head is more movable than the breech, for two reasons:—First, on account of its globular shape, it is not so completely invested by the uterus as is the breech, but is only in contact with the uterine walls at certain places. Secondly, the articulations of the neck enable it to move from side to side independently of the trunk, while the breech, being portion of the trunk, can only move *en bloc* with the latter. In consequence of this, it is possible to ballott the head between the hands—a process which is impossible in the case of the breech. In shape, the head is rounder and more uniform than is the breech. It is separated from the trunk by a groove or depression at the site of the neck, while the outline of the breech is continuous with that of the trunk. Further, in the case of the podalic pole, the feet can usually be recognised lying close to the breech, and in many cases their movements can be felt. In point of size, the podalic pole is the larger. In consistency, the head is considerably harder; but inasmuch as the placenta often lies between the fundal pole of the fœtus and the examining

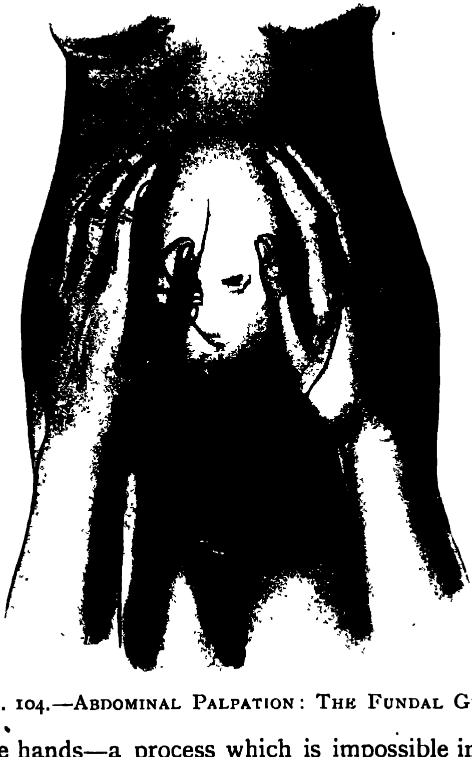

FIG. 104.—ABDOMINAL PALPATION: THE FUNDAL GRIP.

fingers, it is difficult to appreciate this point. If the fundal tumour is displaced to one or other side, so that it lies under the arch of the ribs, and, consequently, cannot be readily palpated, it will be extremely difficult to ascertain its nature. To overcome this difficulty, press the lower pole of the fœtus towards the same side as that at which the upper pole lies. This will have the effect of displacing the upper pole forwards, and towards the middle line, and so enabling its nature to be determined.

Second Grip.—The second, or umbilical, grip is made by applying both hands to the sides of the uterus, so that the fingers lie at each side of the middle line, about the level of the umbilicus. Then, by gently depressing and rotating the fingers as before, we can in the large majority of cases determine the fact that there is a flat resisting mass at one side, while at the other there is either no marked resistance, or one or more small irregular prominences can be felt. If there is any difficulty in determining the existence of greater resistance at one side than at the other, the hands placed at each side of the uterus are moved synchronously first towards one side and then towards the other. By this means,

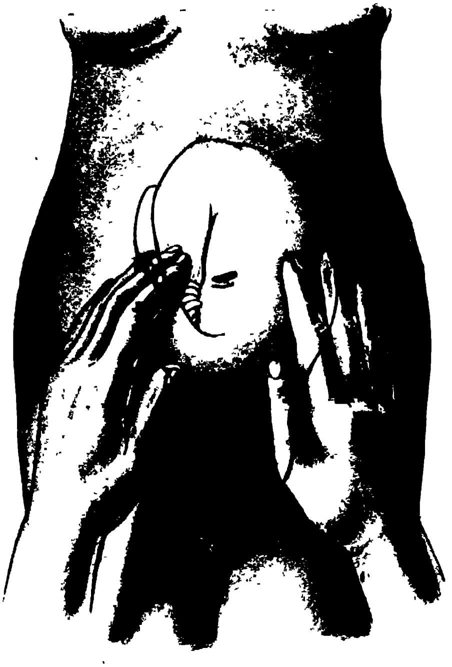

FIG. 105.—ABDOMINAL PALPATION: THE UMBILICAL GRIP.

it will be found that a greater resistance is offered to one hand than to the other. If this area of resistance is followed upwards and downwards, it will be found to merge itself in the fundal pole of the fœtus above, and in the pelvic pole of the fœtus below. This resistance is caused by the presence of the back of the fœtus, while the irregular prominences at the opposite side are formed by parts of the limbs. More rarely, the umbilical grip may determine the presence, not of the smooth and more or less flat outline of the back, but of a rounded mass similar to the mass which is usually found at the fundus. This mass is formed either by the fœtal head or breech.

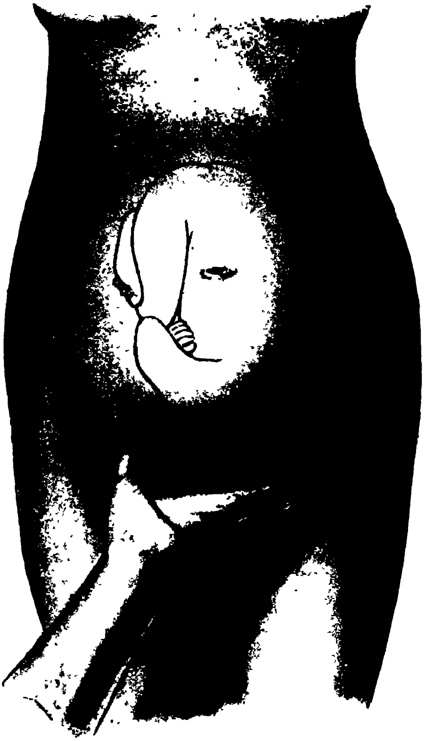

FIG. 106.—ABDOMINAL PALPATION: THE FIRST PELVIC GRIP.

Third Grip.—The third, or Pawlic's, grip is the first of two forms of pelvic grip. It is made with the fingers of one hand as follows:—Separate the fingers of the right hand from the thumb as far as possible. Then, sink the fingers into the false pelvis immediately above Poupart's ligament on the patient's left side, and the thumb into a corresponding point on the right side. If the fingers and thumb are then approximated, they will find between them a solid body. If the patient is not in labour, this solid body can only be one or other of the fœtal poles—*i.e.*, either the head or the breech. The diagnosis between them is not difficult, and is made as in the case of the fundal pole. The head is firmer and rounder than the breech. There is a groove between it and the body—the groove of the neck—which usually runs obliquely upwards, and is lowest on the side of the fœtal back; and, if the head is not

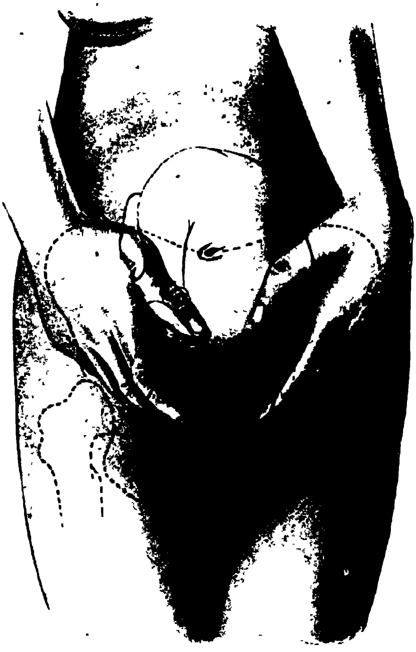

FIG. 107.—ABDOMINAL PALPATION: THE SECOND PELVIC GRIP.

fixed, it is more movable than the breech on account of the cervical articulations. Further, in the case of the breech, the feet may be felt to one or other side. If the patient is in labour, and the head has passed the brim, the resistance experienced by the fingers may also be due to some portion of the fœtal trunk which has become, or is becoming, impacted in the pelvis. In such a case, the part of the fœtus which is most usually felt is formed by the shoulder and a part of the back. If there is a cephalic presentation, and if the patient is in labour, there may be either a vertex, a face, or a brow presentation. In the case of a vertex presentation, as has been mentioned, the groove of the neck runs obliquely upwards, being lowest on the side of the back, inasmuch as the chin lies higher than the occiput. Also, the head lies higher above the brim on the side of the face—*i.e.*, on the opposite side to that at which the back is felt—than it does on the side of the occiput. In the case of a brow presentation, the groove of the neck is almost horizontal, as the occiput and chin lie almost on the same level. In the case of a face presentation, the groove of the neck again runs obliquely, but it is higher on the side of the back, as the chin here lies lower than the occiput. If the head is fixed in the pelvic brim and labour has not commenced, we know that the vertex must be presenting (Pinard).

Fourth Grip.—In making the fourth, or second pelvic, grip, the examiner turns round so as to face the feet of the patient. He then places the finger-tips of both hands above Poupart's ligament, one on each side, and endeavours to sink them down as far as possible into the pelvic brim. Whilst doing this, he may experience one of two sensations. He may find that his fingers are arrested by a firm, resistant mass, or he may find that they sink without difficulty into the pelvic cavity, experiencing no more resistance than is caused by the abdominal walls and subjacent soft parts. In the first case, the presenting part has entered or has passed the brim of the pelvis, and is fixed there; in the second case, the presenting part is not fixed. If the head has sunk deeply into the pelvis, the diagnosis of the actual presentation is made by noting the difference in its level at each side. If the pelvic brim is discovered to be empty, the fingers are drawn slightly upwards and the false pelvis carefully palpated. When the lie is longitudinal—*i.e.*, in the majority of cases, one or other pole of the fœtus will be found freely movable just above the brim. When the lie is transverse or oblique, a fœtal pole will be found lying in one or other iliac region, or even higher at one or other side of the umbilicus.

Accordingly, by means of these four grips, it is possible to ascertain the lie, presentation, and position of the fœtus. Whether the lie is longitudinal or transverse is determined by noting the fact that the back lies more or less vertically, or more or less transversely; 2 while cephalic presentations are distinguished from podalic presentations by noting the characteristics of the fundal and pelvic pole of the fœtus. The various presentations of the head are mainly determined by noting the relative heights of the chin and the occiput. It is more difficult to determine the exact nature of the presentation in podalic lies. If the feet are felt near the pelvic brim, we know we are dealing with a complete pelvic presentation; but inasmuch as this may change during labour, owing to the feet becoming caught at the brim, the knowledge is not of any great practical importance. 3 The position of the fœtus is determined by the umbilical grip, by means of which we ascertain in longitudinal lies at which side the back is situated, and in transverse lies at which side the head is situated.

3 **The Diagnosis of the Course of Labour.**—In making a diagnosis of the course of labour, the same method of palpation is adopted as in diagnosing presentations and positions. The course of labour can be followed, first, by noting the descent of the presenting part, and, secondly, by noting the changes in the form of the uterus. The descent of the presenting part is followed by the pelvic grips. By the first pelvic grip, we can ascertain the fixation of the presenting part, and can follow its descent until the chin has passed the brim. By the second pelvic grip, we can follow its descent after this has occurred. The advantages of this method of following the course of labour over the more usual method of repeated vaginal examinations will be subsequently discussed.

The changes, which take place in the form of the uterus, will be more readily understood after the mechanism of labour has been discussed. Here, it is sufficient to state that, after the membranes have ruptured and the liquor amnii has in great part escaped, the ovoid form of the uterus is to some extent lost, as the latter contracts down more tightly on the fœtus. Also, and in consequence of this, the mobility of the fœtus inside the uterus is diminished.

4 **The Presence of Complications.**—In order to determine the presence of complications, the following information must be ascertained:—The relation of the presenting part to the pelvic brim; the distinctness with which the fœtal parts can be felt; and the effect of the uterine contractions on the uterine muscle.

(1) *The Relation of the Presenting Part to the Pelvic Brim.*—As we shall presently learn, the relation of the presenting part to the pelvic brim depends upon the period of pregnancy, and on whether the patient is a primipara or a multipara. In normal cases, the rule is that the presenting vertex is fixed in the pelvic brim during the last three or four weeks of pregnancy in the case of a primipara, whilst in the case of a multipara it is not fixed until she actually comes into labour. In abnormal cases, on the other hand, in which either the normal relations between the size of the presenting part and the size of the pelvic brim are altered, or in which there is some obstacle to the descent of the presenting part, the latter is not found fixed in the brim at the usual time. The fixity or non-fixity of the presenting head at a time at which it ought to be fixed is a point on the importance of which too much insistence cannot be laid. It is perhaps the most important point which is brought out by abdominal palpation, inasmuch as if the head is fixed at the proper time almost every abnormality which may affect the first two stages of labour is eliminated; while, on the other hand, if the head is not fixed, we know that something is wrong, the nature of which must be determined as soon as possible. The non-fixity of the presenting part may be due to the

presence of the following pathological conditions:—Malpresentations of the head; multiple pregnancy; contracted pelvis; lateral or anterior displacements of the uterus; hydrocephalic head; placenta prævia; hydramnios (excessive amount of liquor amnii); tumours of the uterus, of the genital organs, or of the pelvis, lying in or near the brim; fœtal malformations.

The diagnosis of the exact cause of the non-fixation will be made by further examination, the details of which will be subsequently described.

(2) *The Distinctness with which the Fœtal Parts can be felt.*—In normal cases, there should be no great difficulty in palpating the fœtal parts, unless the patient is stout, or the abdominal muscles are rigidly contracted. In the absence of either of these causes, difficulty is indicative of the presence of some abnormal condition. Such conditions are:—Hydramnios; tumours of the uterus; tumours of the ovaries; ascites; intra-uterine hæmorrhage; an abnormally situated placenta; tonic contraction of the uterus; hydatidiform mole; a macerated fœtus.

(3) *The Effect of the Uterine Contractions on the Uterine Muscle.*—As will be seen when the phenomena of labour are discussed, certain definite changes occur in the uterine muscle as labour proceeds, and become more marked the longer labour lasts. When labour is prolonged to a pathological extent, these changes make themselves obvious by their effect on the uterine contractions, on the situation of the retraction ring, and on the round ligaments, all of which can be ascertained by abdominal palpation. The character of the uterine contractions is determined by laying the hand gently on the uterus, and noting the force and the duration of the contraction, and the length of the interval between succeeding contractions. The situation of the retraction ring, or junction between the upper and lower uterine segments, is found by palpating the uterus from the level of the umbilicus downwards, when in certain cases the ring will be felt as an oblique depression of the uterine wall. A round ligament can be felt by gently drawing the fingers across the sides of the uterus from the region of the anterior superior spine of the ilium towards the umbilicus. The ligament will then be felt as a thickened cord, which slips under the fingers. As a rule, owing to the dextro-torsion of the uterus, only the left round ligament can be reached.

V. VAGINAL EXAMINATION

The examination of the vagina is the oldest method of diagnosing the existence of pregnancy and the course of labour, and in spite of the not inconsiderable danger by which it is accompanied, it is still the most favourite method. The relative advantages of palpation and of vaginal examination will be subsequently discussed.

Under the heading 'Vaginal Examination' is also included combined abdomino-vaginal examination or bi-manual examination, as this method is often used instead of simple vaginal examination, particularly in the early months of pregnancy.

A simple vaginal examination is made as follows:—The patient is placed on her left side, her hips projecting slightly beyond the side of the couch, and her knees a little flexed, the external genitals having been cleansed and disinfected as has been already described. The examiner, having then washed and disinfected his hands, separates the labia with the fingers of the left hand, and gently passes the fore-finger, or the fore and middle fingers, of the right hand into the vagina, if possible without touching the external genitals. The finger is then passed upwards towards the upper limit of the vagina, and the cervix, the vault of the vagina, the vaginal mucous membrane, and the vulvar orifice carefully in turn examined. During pregnancy, we examine the cervix with the object of determining its consistence and shape, and the presence of any pathological conditions, such as lacerations or tumours. During labour, we examine it with the object of ascertaining the extent to which it has been taken up into the body of the uterus, the degree to which it is dilated, and the nature of the presenting part which is felt through it. The presenting part is examined with a view to determine its nature, and to ascertain whether it is fixed in the pelvic brim or not. The nature of the presenting part is determined by noting its shape and contour, and its surface markings. A vertex presentation, or an anterior or posterior fontanelle presentation, presents a smooth and rounded surface, intersected by various surface markings. A distinction is made between them by noting the shape of these surface markings—*i.e.*, of the sutures and fontanelles, and their position relative to one another and to the pelvic cavity. A face presentation is

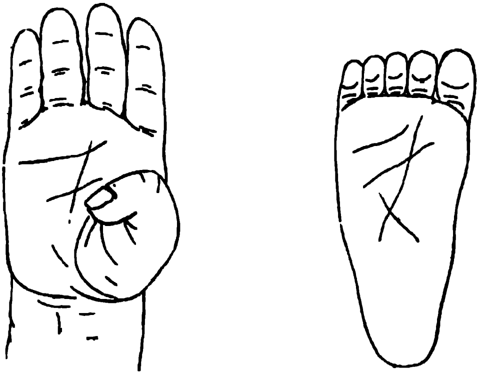

FIG. 108.—THE HAND AND THE FOOT OF THE NEW-BORN INFANT.

felt as a more or less irregular and hard surface, according to the degree to which its outlines are obscured by the presence of a caput succedaneum. Its characteristic markings are furnished by the outlines of the facial bones and by the aperture of the mouth. A brow presentation is distinguished by the fact that one side of the presenting part is smooth and rounded, with the characteristics of the cranium, the other side irregular, with the characteristics of the face. A pelvic presentation is felt as a smooth, rounded surface, softer than the head, but offering three points of bony resistance, formed by the tuberosities of the ischium and the tip of the coccyx. Its surface markings are the aperture of the anus, the external genitals, and, if the finger is passed upwards, the cleft between the thighs, or between each thigh and the abdominal wall. If the pelvic presentation is complete, the feet will, in some cases, be felt at one or other side. A shoulder presentation, when driven into the brim, presents a smooth and somewhat rounded surface, which is softer than the cranium, and which possesses certain bony landmarks, formed by the shoulder-joint and the ribs. This presentation, as well as some of the others, may be complicated by the presence of a limb. In such cases, the examining finger may reach an elbow or a hand, a knee or a foot. These parts are recognised by their shape and range of movement (*v.* Fig. 108). A hand is relatively smaller than a foot, the outline of the tops of the fingers is curved, the thumb can be opposed and apposed to the palm. On the

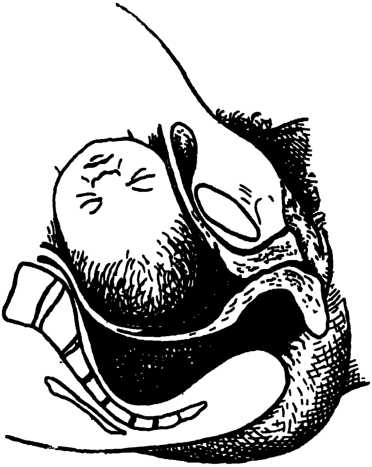

FIG. 109.—DIAGRAM REPRESENTING THE NORMAL BALL-VALVE ACTION OF THE HEAD, AND THE CONSEQUENT SLIGHT PROTRUSION OF THE MEMBRANES INTO THE VAGINA.

other hand, the outline of the tops of the toes is straight, the articulations of the great-toe do not permit of any lateral movement, while the shape of the os calcis is characteristic. The elbow is relatively smaller than the knee, and lacks the patellar ligament and the tuberosity of the tibia. To determine whether the presenting part is fixed or not, endeavour to gently push it upwards. If this is possible, it is obviously not fixed.

The condition of the membranes is next ascertained, with the view of determining whether they are intact or not, and, in the former case, the manner in which they protrude into the vagina during a contraction of the uterus is also noted. As has been already mentioned, abdominal palpation furnishes us with a simple means of telling in a reliable manner whether labour is likely to be uncomplicated or the reverse. If we find that the head is fixed in the pelvic brim at a time at which it ought normally to be fixed, we know that most complications which can offer an obstacle to the descent of the fœtus are absent. Similarly, vaginal examination affords a valuable criterion by which we can determine the presence or absence of such complications. This consists of the extent to which the membranes protrude into the vagina during a contraction of the uterus. Under normal circumstances, the liquor amnii is divided into two portions—a larger portion which surrounds the body of the fœtus, and a smaller portion which lies in front of the head. Prior to the fixity of the head and the onset of labour, these two portions communicate with one another, but,

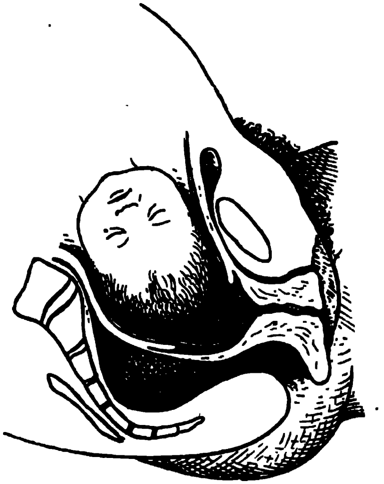

FIG. 110.—DIAGRAM REPRESENTING THE FAILURE OF THE BALL-VALVE ACTION OF THE HEAD, AND THE CONSEQUENT COMMENCING UNDUE PROTRUSION OF THE MEMBRANES INTO THE VAGINA.

as soon as active contractions of the uterus commence, this communication is interrupted by what is known as the ball-valve action of the presenting head. This action is very simple and effective. When a contraction of the uterus occurs, the head is driven down and plugs the lower segment of the uterus so completely that, in spite of the increased intra-uterine pressure, no liquor amnii is driven downwards below the head. The stronger is the driving force, the more tightly does the head plug the canal in which it is lying. The extent to which the membranes protrude through the cervix depends upon the amount of liquor amnii which lies in front of the head, and, as we now see, this amount depends on the effectiveness or failure of the ball-valve action of the head. Normally, the amount of fluid in front of the head is small, and if the ball-valve action is perfect is not increased during a contraction (*v.* Fig. 109). If, on the other hand, there is a failure in this action, with each contraction additional liquor amnii is driven down and the membranes protrude into the vagina in the form of a long finger-shaped or pear-shaped cyst, which may completely fill the vagina or may even bulge outwards externally (*v.* Figs. 110, 111). Failure in the ball-valve is caused by any condition which affects the shape of the presenting part, or of the canal into which it should fit, or which prevents the head from descending into its proper position in the canal. Consequently, by determining the manner in which the membranes protrude into the vagina during a contraction, we are enabled to ascertain the presence or absence of any con-

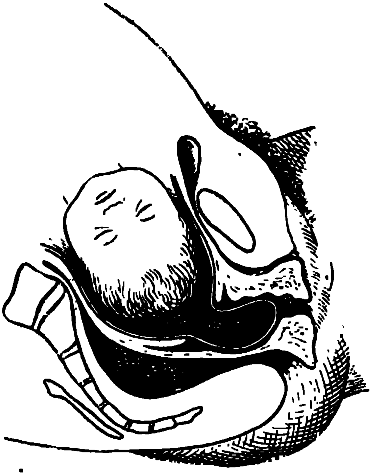

FIG. 111 — DIAGRAM REPRESENTING THE FAILURE OF THE BALL-VALVE ACTION OF THE HEAD, AND THE CONSEQUENT MARKED PROTRUSION OF THE MEMBRANES INTO THE VAGINA.

dition which offers an obstruction to the descent of the presenting part.

5 If the membranes are ruptured, the caput succedaneum will be felt, and can usually be distinguished without difficulty. A large caput succedaneum may possibly be mistaken for unruptured membranes—a mistake which may lead to serious consequences if attempts are made to rupture it. A diagnosis can usually be made by examining the swelling during a contraction of the uterus, as the bag of membranes will then immediately become tense and as rapidly relax again as the contraction passes off, while a caput succedaneum will not alter. Further, a caput succedaneum will pit under the pressure of the examining finger, while in the case of the bag of membranes the finger will momentarily displace fluid, which will at once return when the pressure is relaxed. Occasionally, however, there is no fluid in front of the head, and in such cases, where flaccid membranes lie close to a large caput succedaneum, the difficulty of ascertaining the presence of these membranes is considerable. A caput succedaneum may also be mistaken for, or confounded with, an encephalocele. In the case of the latter, however, the skin covering it is not œdematous, and the contents can, as a rule, be pushed back into the cranial cavity.

The last point to be determined in the region of the cervix is the presence of any complication such as prolapse or presentation of the cord or abnormally low situation of the placenta. The characteristics of the cord are so obvious that it cannot be mistaken. A placenta which is situated within reach of the examining finger can also be readily recognised. It may be simulated by a firm clot lying inside the cervix, but a clot can be readily broken down by slight pressure of the finger, while the placenta is more resisting as it is firmer in consistency.

The vaginal vault is next examined with the object of determining the presence of any tumours situated in the pelvic cavity, and springing from either the uterus or the pelvic bones. At the same time, the contour of the pelvic brim should, if possible, be also examined to ascertain the presence of any small projections or of marked contraction. If there is any reason to suspect the presence of tumours or deformities of the pelvis, the patient should be placed under an anæsthetic, the hand introduced into the vagina, and the internal surfaces of the pelvis thoroughly examined.

The vaginal mucous membrane is next examined in order to determine its character, the presence or absence of cicatrices, ulcers, or fistulæ, and the nature and amount of the fluid with which it is bathed. The finger is also swept round the pelvic cavity with a view to ascertaining its size and the presence of any bony outgrowths or marked contraction of the outlet.

Finally, the vulva and perinæum are examined, with the object of ascertaining the size and dilatability of the vulvar orifice, the presence of old lacerations, or of any other pathological condition.

A combined abdomino-vaginal, or bi-manual, examination is made as follows:—The patient lies on her back on a couch or bed, or, by preference, on a gynæcological chair, her legs flexed and abducted. If the patient is on a couch, the examiner stands or kneels by her side, and, separating the labia with the fingers of the left hand, passes the right fore-finger, or fore and middle fingers, into the vagina. The fingers are passed upwards until they lie beneath the cervix, and then the fingers of the opposite hand are placed on the abdominal wall; the tips are sunk into the abdomen in the region of the middle line, slightly below or about the level of the umbilicus, and an attempt is made to ascertain what lies between the fingers. The abdominal fingers are gently rotated over the region of the false pelvis, with the object of ascertaining the outlines and size of any tumour which may be formed by, or be in the region of, the uterus. If no resistance is felt between the fingers, the vaginal fingers are passed into the posterior fornix, and the abdominal fingers are sunk more deeply into the pelvis. In this manner, the presence of any tumour in Douglas's pouch is determined. As soon as this has been done, the fingers are drawn to one or other side of the middle line, and the vaginal fingers are moved into the corresponding vaginal lateral fornix. Then, both hands are drawn gently downwards towards the anterior wall of the pelvis and parallel with the plane of the pelvic brim. In this manner, the presence of any tumour situated to one or other side of the middle line is ascertained. If the patient is on a gynæcological couch, a more careful examination can be made. In such a case, the examiner stands in front of the couch, and, placing his right foot on a stool, passes the fingers of his right hand into the vagina. He then rests the right elbow on the right knee, in order to allow the vaginal fingers to be free from the cramping weight of the arm. The remainder of the examination is made as has been described, save that it is generally considered advisable to examine the left side of the pelvis with the right fingers in the vagina and the left hand on the abdominal wall, and the right side of the pelvis with the hands reversed—*i.e.*, with the left fingers in the vagina. In order to make a satisfactory examination three points must be attended to:—The bladder must be empty; all unnecessary movements of the vaginal fingers must be avoided; and all movements of the fingers must be made as gently as possible.

By means of a combined abdomino-vaginal examination, we can determine the shape, size, and consistency of the uterus in the early months of pregnancy, the presence or absence of any tumour in the pelvis, the presence of any alteration in the consistency of the lower uterine segment, and the presence of any movable body inside the uterus. The method of determining the consistency of the lower uterine segment and the presence of any movable body inside the uterus requires a more detailed description.

As will be subsequently learnt, an important phenomenon of pregnancy is the softening of the lower uterine segment. The effect of this softening is to convey the impression to the examining fingers that the body of the uterus is globular in outline and firm in consistency, that the cervix is also firm in consistency, and that the intermediate part of the uterus—*i.e.*, the lower part of the body and the upper part of the cervix—is non-existent (*v.* Fig. 112).

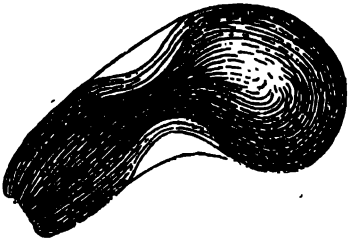

FIG. 112.—HEGAR'S SIGN OF PREGNANCY.

Diagram showing the effect of the softening of the lower segment of uterus. The outline shows the actual shape of the uterus; the shaded portion its apparent shape as felt by bi-manual examination.

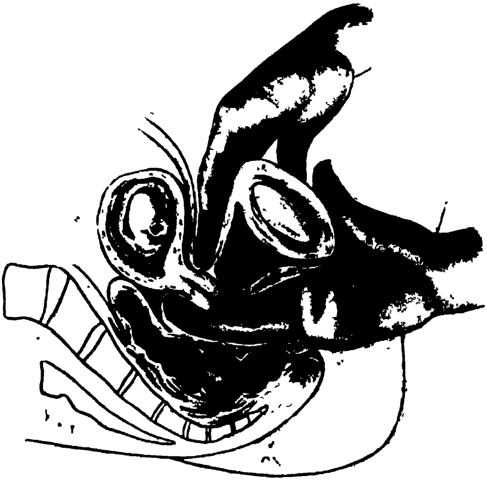

FIG 113.—HEGAR'S SIGN OF PREGNANCY.

The method of obtaining the sign by bi-manual examination.

This apparent obliteration of the lower uterine segment is known as Hegar's sign of pregnancy, and is due to the extreme softening which the uterine tissue undergoes in this region. It will be again referred to in its proper place. Its presence can be ascertained in two ways. Press the body of the uterus gently downwards into the pelvis with the hand on the abdominal wall, and with the vaginal fingers grasp the junction of the body and cervix between the index finger in the posterior fornix and the thumb in the anterior fornix. If the softening of pregnancy is present, the yielding nature of the cervix will be so marked that the finger and thumb can be almost brought into contact with one another, while above will be felt the relatively firm body, and below the relatively firm cervix. The alternative method consists in sinking the fingers of the abdominal hand into the

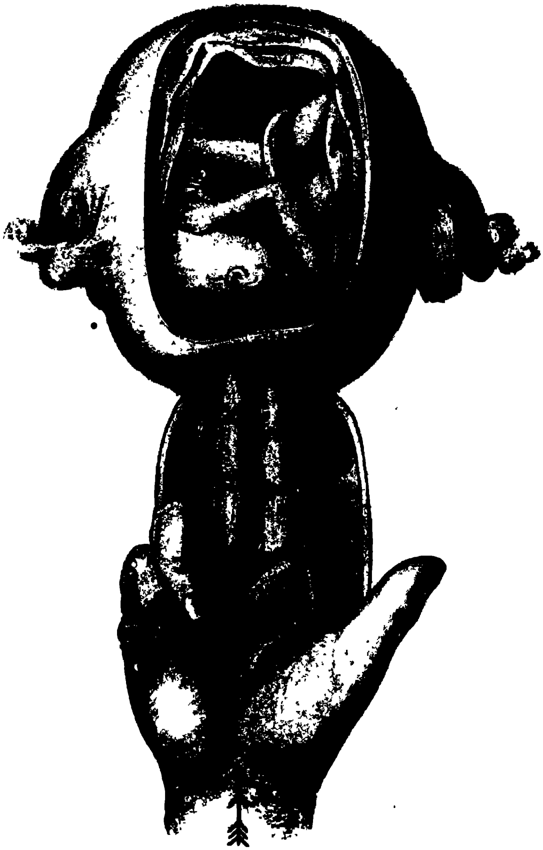

FIG. 114.—INTERNAL BALLOTTEMENT.

Diagram showing the manner in which internal ballottement is obtained, the fingers in the vagina pushing the presenting part upwards.

pelvis immediately above the symphysis, taking care that they are below the body of the uterus. Then pass the vaginal fingers into the posterior fornix and endeavour to approximate them to the fingers of the other hand. In this way, the entire lower uterine segment will be included between the fingers, and it will be possible to estimate its consistency (*v.* Fig. 113).

The presence of a movable body inside the uterus can be ascertained by the performance of internal ballottement, a procedure which is identical in its object with the performance of external ballottement. The vaginal fingers are placed under the body of the uterus, in the anterior fornix if the uterus is in its normal position, in the posterior fornix if it is retroverted. Then, push the fingers suddenly upwards against the most dependent part of the body of the uterus in such a manner as to slightly depress its wall, and keep them in this position for a moment. If the uterus (*v.* Fig. 114) contains a fœtus of sufficient size to be felt and sufficiently mobile to be displaced in the liquor amnii by the upward push, a gentle tap—the *choc en retour*—will be felt by the fingers as the fœtus again floats down into its former position.

AUSCULTATION

Auscultation of the uterus as a means of diagnosis is entirely a product of the nineteenth century. In 1818, Mayor of Geneva announced that the pulsations of the fœtal heart could be heard in advanced pregnancy by the ear applied to the abdomen of the mother.* His discovery did not apparently at the time attract any great attention, and it was not until a few years later that the possibility of auscultating the heart became generally known through a communication to the French Academy by Lejumeau de Kergaradec.† The latter, whilst endeavouring to determine whether it was possible to hear the wave-sound produced in liquor amnii by the motions of the fœtus, heard instead a sound which he compared to the ticking of a watch. He noted that these sounds were repeated from 143 to 148 times in the minute, while the pulse-rate of the mother was only 70. The importance of this method of deciding the presence and life of the fœtus was apparent to both observers. Lejumeau de Kergaradec followed his discovery by another of equal interest, though of not so great practical importance, namely, the detection of the existence of a blowing sound or souffle synchronous with the pulse-rate of the mother. Evory Kennedy—a former master of the Rotunda Hospital—advanced the knowledge of obstetrical auscultation a step further by describing a pulsation and a souffle heard in advanced pregnancy, and having their origin in the vessels of the

* 'Bibliothèque Universelle de Genève,' tom. ix., November, 1818.

† 'Mémoire sur l'Auscultation appliqué à l'Étude de la Grossesse,' Paris, 1822.

umbilical cord, and so called by him the funic souffle. These sounds were synchronous with the fœtal heart.* In 1838, Naegele drew attention to the fact that 'the sound produced by the plunging movements of the child's limbs can be heard much earlier than they can be felt by the practitioner, or even by the patient herself.'† Finally, in 1847, Depaul described the practice of auscultation as a means of diagnosing the presentation and position of the fœtus.‡

From the time of Depaul on, the practice of auscultation as a means of diagnosing the existence, the life, the presentation and position of the fœtus, and even the probable situation of the placenta, has steadily increased in popularity. At the present day, when the importance of supplanting internal by external manipulations is appreciated, the importance of auscultation is fully recognised, both as a mode of diagnosis for which there is no substitute, and as an auxiliary to abdominal palpation.

Auscultation can be carried out either through the intermediary of a stethoscope, or directly by placing the ear on the abdomen. Through the intermediary of a stethoscope is for many reasons the more suitable method, but in some cases it may be impossible to detect the sounds for which we are listening in this manner, whilst if the ear is placed directly on the abdomen they are readily heard. A binaural stethoscope is the best form to use with thick rubber tubes, as it is difficult to keep a straight stethoscope in position over an enlarged uterus. In all cases in which a stethoscope is used, the abdomen must be bare; but if the ear is applied directly, it may be first covered with a thin linen or silk handkerchief.

By listening over the abdomen of a pregnant woman a number of different sounds can be heard. These sounds can be differentiated into two classes:—

(A) Maternal sounds.
(B) Fœtal sounds.

MATERNAL SOUNDS.—The maternal sounds may be either produced in the uterus itself, or in some of the other maternal organs. They are as follows:—

(1) **The Uterine Souffle.**—The uterine souffle, or the uterine bruit, is a blowing, or sibilant sound which is synchronous with the pulse of the mother. It is subject to great ranges of alteration in its intensity, length, exact character, and situations, not only in different patients, but in the same patient from one moment to the next. It has been said that the true souffle of pregnancy has never been perfectly imitated in any other condition of the system (Naegele), but perhaps the sound which it most closely resembles is that heard over a varicose aneurism in which venous and

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* 'Evidences of Pregnancy,' 1833, p. 121.

† 'Die Geburtshülfliche Auscultation,' 1838, p. 62.

‡ 'Traité d'Auscultation Obstétricale,' 1847.

arterial blood mix (Montgomery).* Its character is not, however, by any means sufficiently well defined to enable a diagnosis of pregnancy to be based upon it. When the uterus commences to contract, the souffle becomes louder, and then gradually diminishes as the contraction reaches its height until it becomes almost or quite imperceptible. As the contraction passes off, the souffle again returns, and, when the contraction has ceased, regains its former character. At one time, it was believed that the souffle originated in the placenta, and consequently it was termed the placental souffle (Monod, Hohl). This, however, has been long disproved, inasmuch as it is not loudest over the placenta, and has been heard after the expulsion of the latter. Other theories have placed the murmur in the aorta and iliac vessels (Bouillaud), and in the epigastric artery (Kiwisch). It is, however, now generally recognised that the souffle is a true 'uterine souffle' and is produced in the ascending branches of the uterine artery, as on any other hypothesis it would be difficult or impossible to explain the effect which the contractions of the uterus have upon its character. It is possible, however, that a small contributory souffle may also be produced in some of the neighbouring viscera or large vessels. It is also possible that the altered character of the blood in pregnancy may have some relation to the production of the souffle, in the same manner as a subclavian bruit is produced in anaemia. Winckel considers that the souffle is produced not only in the arteries of the uterus, but also in the veins, and that when it is continuous in character it is venous, when intermittent, arterial. In the first half of pregnancy, the souffle can be heard best in the middle line immediately above the symphysis pubis. In the latter half, it can be heard best over the lateral aspect of the lower half of the uterus, and particularly on the left side of the patient, on account of the dextro-torsion of the uterus. It is less frequently detected over the fundus. The souffle is first heard during the end of the fourth month—the sixteenth week, and has been heard up to ninety-nine hours after delivery. It can also be heard after the death of the fœtus (Bailly).

(2) **Cardiac Sounds.**—The sounds of the maternal heart can usually be distinctly heard over the uterus. If their rate is increased, they are apt be to mistaken for the sounds of the fœtal heart. To obviate this, it is always well to listen to the supposed fœtal heart with the finger on the maternal pulse, as any considerable difference is thus easily detected. If there is no apparent difference between the rate of the supposed fœtal heart and that of the maternal pulse, each should be counted separately, and by this means confusion will be avoided.

(3) **Aortic Pulse.**—This may occasionally be heard as a dull sound synchronous with the maternal heart.

(4) **Intestinal Sounds.**—Intestinal sounds, or borborygmi, due

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* 'Signs and Symptoms of Pregnancy,' by W. F. Montgomery, 2nd edit. London, 1856, p. 214.

to the movement of fluids and gases in the intestines, are frequently heard. They cannot be confounded with any other sound.

(5) **Respiratory Sounds.**—The vesicular murmur of the mother may be transmitted to the uterus, and cannot infrequently be heard at the left side, especially in cases of dyspnœa.

(6) **Friction Sounds.**—These are occasionally heard, and are probably produced between the uterus and the abdominal wall in cases of peritonitis.

(7) **Crepitatory Sounds.**—These are crackling or bubbling sounds, produced either inside the uterus or in the uterine walls, and are most frequently the result of putrefaction of the fœtus. They may also arise in the abdominal wall in the rare instances of emphysema of the abdominal wall, due to the presence of gas-producing bacteria.

(8) **The Muscular Susurrus.**—This is the term applied to a dull note given out by contracting muscle fibre. As heard over the uterus, it is produced by the contractions of the latter.

FŒTAL SOUNDS.—The various sounds which are produced by the fœtus are as follows:—

(1) **Cardiac Sounds.**—The fœtal heart sounds are the most important of all the auscultatory phenomena. They are double, and closely resemble the 'tic-tac' of a watch beating beneath a pillow. Their average rate is 140 per minute, and the highest and lowest rate in the case of infants, who have been healthy at birth, is respectively 160 and 120 (Depaul).* On the other hand, in pathological cases, the rate has fallen as low as 60 per minute (Pinard), and has reached a rate so high that it could not be counted. Under normal circumstances, the rate of the heart frequently alters within a short space of time. It has been stated by some authorities that it is possible to determine the sex of a fœtus by ascertaining the average rate of its heart (Frankenhaüser, Ziegenspeck). As, however, there is very little difference in the reputed average rate of the two sexes—136 in the case of a male, and 139 in the case of a female (Ziegenspeck)—the difference, even if actual, is of little or no value for diagnostic purposes. It has also been stated that the rapidity of the heart is in inverse proportion to the development of the fœtus. The weight of the latter is said to be over 2,900 grammes (6 lbs. 6 oz.), when the heart beats at a rate of 129 per minute, and under this figure with more frequent pulsations. However this may be, it is sufficient for us, as practical obstetricians, that, as Winckel says, 'the fœtal cardiac sounds give us very good hints as to the position, presentation, and condition of the child, often aid in making the diagnosis of multiple pregnancies, and warn us of impending danger to the child.'

The rate of the fœtal heart is affected by the occurrence of uterine contractions, active fœtal movements, the duration of labour, circulatory disturbances—such as are caused by pressure on the placenta or the cord, fœtal diseases—such as syphilis, and such diseases of the mother as are accompanied by elevation of temperature. The effect of uterine contractions will be noted later. Active fœtal movements and maternal elevation of temperature increase the rate, while pressure on the placenta and cord at first diminish it, then, if continued, increase it, and finally, if sufficient to eventually bring about the death of the fœtus, again diminish it.

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* 'Traité d'Auscultation Obstétricale.'

The site at which the fœtal heart is best heard differs according to the lie, presentation, and position of the fœtus. As a general

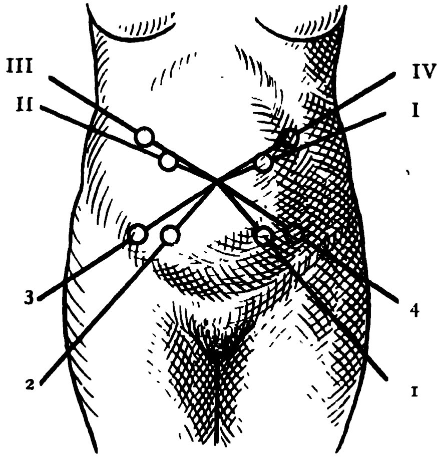

FIG. 115.—SITE OF MAXIMUM INTENSITY OF FŒTAL HEART-SOUNDS IN VERTEX AND PELVIC PRESENTATIONS.

1, 4, First vertex presentation, back in front and behind; 2, 3, second vertex presentation, back in front and behind; I, IV, first pelvic presentation, back in front and behind; II, III, second pelvic presentation, back in front and behind.

rule, it may be stated that it is best heard over that part of the fœtal trunk which is nearest to the heart, and which is in contact with the anterior uterine wall. The site of maximum intensity in the different presentations is shown in the accompanying diagrams (*v.* Figs. 115, 116), and will be referred to when discussing these presentations. The earliest date at which the fœtal heart can be heard is usually stated to be at or about the eighteenth week. It may, however, be further stated that it is only in exceptionally favourable cases, and by an obstetrician possessed, not only of keen hearing, but of considerable skill in auscultation, that it can be heard at this period. It may be well to add that, in order to be certain that we hear the fœtal heart, we must be able to count its rate, in order, not only to exclude the possibility of mistaking the pulsations of the maternal heart or of our own arteries for it, but to ensure that we are listening to a definite rhythmical sound. In this connection, we may be permitted to recall a case in which Labatt was once called into consultation, and in which the attending physician hesitated to extract the fœtus by means of a crotchet because he had heard the fœtal heart. On a further examination of the patient, it turned out that she was not pregnant.

(2) **Funic Souffle.**—The funic souffle is a blowing sound, which is heard in certain cases on listening over the fœtus, and which is synchronous with the fœtal heart. Three sites at which it may arise have been suggested. The first of these is in the fœtal heart—a fœtal endocardial murmur (Massman, Ahlfeld). Such an occurrence undoubtedly does occur in cases of intra-uterine cardiac disease, but it is a rare, and not the common, cause of a fœtal souffle. The second of the suggested sites is in the vessels of the cord at the umbilicus (Hecker, Schroeder)—an umbilical souffle. This is also a possible site of production, but is by no means the invariable one. The commonest site of production is in the umbilical vein, at any point in the cord at which the flow of blood is obstructed (Evory Kennedy,* Winckel). Such obstruction may be caused by tension, as where the cord is wound tightly round the neck of the fœtus; by pressure, as where the bell of the stethoscope compresses the funic vessels against the

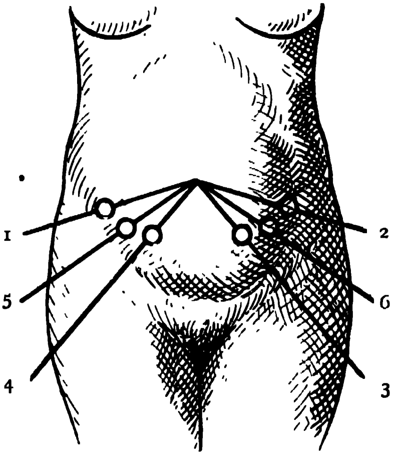

FIG. 116 – SITE OF MAXIMUM INTENSITY OF FŒTAL HEART-SOUNDS IN FACE AND BROW PRESENTATIONS.

1, Chin to right and behind; 2, chin to left and behind; 3, chin to left and in front; 4, chin to right and in front; 5, chin to right; 6, chin to left.

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* *Op. cit.*, p. 122.

back of the fœtus; by some displacement, resulting in an incomplete kinking of the cord, or by a partial obliteration of the lumen of the funic vessels. In the last case, it may be that, as is suggested by Pinard, the obstruction is caused by the presence of the semilunar folds, which have been noted by Hyrtl, in the interior of the umbilical vessels. In such cases, Pinard suggests that the souffle will be single if the folds occur in either the vein or the arteries, and that it will be double if they occur in both. The funic souffle is, according to most authorities, heard in about ten to fifteen per cent. of cases at full term. Its occurrence is usually considered to be of bad import for the fœtus—a point which it is not difficult to understand, if the causation of the souffle is considered.

(3) **Fœtal Movements.**—The fœtal movements may be sometimes heard on careful auscultation. They occur irregularly as a faint tap on a soft surface, or as a dull sound resembling the beat of the aorta.

Before passing on to the last method of obstetrical diagnosis, it will be well to discuss the relative advantages and possibilities of the three foregoing methods of examining a pregnant or parturient woman—*i.e.*, abdominal palpation, vaginal examination, and auscultation—with the object of ascertaining how far it is possible to replace internal by external manipulations. It may be at once said that, in the diagnosis of pregnancy in the early months, every available method of examination is required; and as at this period the difference between these methods—so far as the safety of the patient is concerned—is not great, we shall only concern ourselves with the comparison of the different methods as used during parturition.

By means of abdominal palpation, we can determine the lie and position of the fœtus, and in a great number of cases the actual presentation. Further, we can follow the course of labour by noting the descent below the brim of the presenting part, and the rupture of the membranes, and we can judge of the effect of the duration of labour on the uterine muscle. We can also diagnose the existence and nature of many abnormalities which affect the body of the uterus or the ovum, and the existence of contracted pelvis and of tumours of the pelvis which project above the brim.

By means of auscultation, we can determine the condition of the fœtus, sometimes recognise the presence of twins, and supplement the information which abdominal palpation has furnished regarding the position and lie of the fœtus.

By vaginal examination, we can determine the exact presentation and lie of the fœtus, and in most cases the position. Further, we can follow the course of labour by noting the descent of the presenting part, the dilatation of the cervix, and the condition of the membranes. We can also diagnose the presence of such complications as presentation of the funis or of the placenta, the prolapse of a limb, or the existence of tumours or other pathological conditions of the cervix, the vagina, or the pelvis.

Accordingly, it is evident that both external and internal examination afford distinct information, and that neither of them can be dispensed with. In practice, however, we shall find that once a case has been determined to be normal, so far as the presentation and the condition of the pelvis and genital passages are concerned—and for this purpose one vaginal examination in addition to abdominal palpation and auscultation is all that is required, vaginal examinations can, as a rule, be dispensed with, save for one which should be made immediately after the rupture of the membranes, in cases in which the head was not fixed when the previous examination was made. The reason for this examination is to make certain that at the time of the rupture of the membranes the funis or a limb has not been swept down into the vagina. This diminution in the number of necessary vaginal examinations is one of the great advances of modern midwifery. It is, however, only rendered possible by the possession of a certain degree of skill in the practice of abdominal palpation and auscultation, a skill which it is the duty of the student to acquire by practice on every available occasion. It must not be thought that external manipulations can replace internal manipulations for diagnostic purposes alone. All through the practice of midwifery, we shall see that an obstetrician who has acquired skill in abdominal palpation can, in many instances, substitute external for internal manipulations, either in great part or altogether. This is a point of no small importance. No matter how carefully the details of antiseptic and aseptic midwifery are attended to, there is always a risk of accidents occurring, and, the more frequently internal manipulations are performed, the more frequent such accidents will be. Inasmuch as it is in the power of every student to acquire skill in palpation without at the same time increasing the risks of the patient's confinement, there is no excuse for his neglecting his opportunities. It is, therefore, incumbent on him to practise abdominal palpation and auscultation in every case of labour in which he has the opportunity.

PELVIMETRY

Pelvimetry is the term applied to the measurement of the various diameters and distances of the pelvis. It is a method of diagnosis which is only required in cases in which the history of the patient, her appearance, or the information furnished by abdominal palpation or vaginal examination lead us to suspect the existence of a contracted pelvis.

In order to be able to recognise the particular variety of contracted pelvis with which we are dealing, certain measurements have to be made. These measurements fall under two headings:—

external measurements and internal measurements, and are as follows:—

I. **External Measurements.**

(1) The distance between the anterior superior spines of the ilium. 10¼ [illegible]

(2) The distance between the most distant portions of the iliac crests. [illegible]

(3) The external conjugate, or Baudelocque's diameter—*i.e.*, the distance between the upper margin of the symphysis and the depression under the spinous process of the last lumbar vertebra. [illegible] Patien[illegible]

(4) The distance between the posterior superior spines. 3

(5) The transverse diameter of the outlet—*i.e.*, the distance between the tubera ischii. 4⅔ [illegible]

(6) The antero-posterior diameter of the outlet—*i.e.*, the distance between the tip of the coccyx and the lower margin of the symphysis. 3⅘-4 [illegible]

(7) The distance between the trochanters. 12⅓ [illegible]

II. **Internal Measurements.**

(1) The true conjugate—*i.e.*, the distance between the promontory of the sacrum and the most prominent part of the back of the symphysis.

(2) The oblique conjugate—*i.e.*, the distance between the promontory of the sacrum and the lower margin of the symphysis.

(3) The transverse diameter—*i.e.*, the greatest distance between the lateral margins of the brim.

EXTERNAL PELVIMETRY.—The different external measurements can be ascertained by means of some of the many modifications

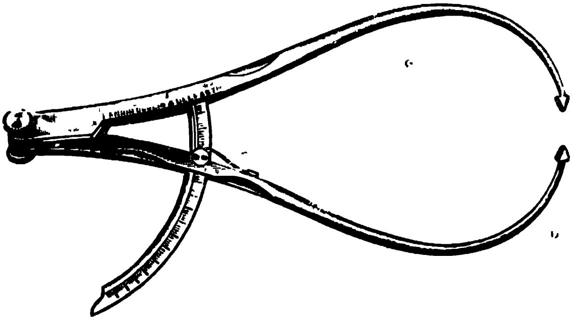

FIG. 117.—MARTIN'S PELVIMETER FOR EXTERNAL MEASUREMENTS.

of Baudelocque's pelvimeter. Martin's modification is, perhaps, the most serviceable and the least cumbersome to carry (*v.* Fig. 117). The method of using it does not require much explanation. To measure the distances between the anterior superior iliac spines, the iliac crests, or the trochanters, the patient lies on her back with her legs close together, while the examiner stands or sits below the level of the hips and facing her. He then takes the pelvimeter in both hands, holding the extremities of the limbs between his thumb and middle finger as shown in Fig. 118, and with the index fingers determines the exact position of the points on which the instrument is to rest. The tips of the instrument are then placed on these points, and

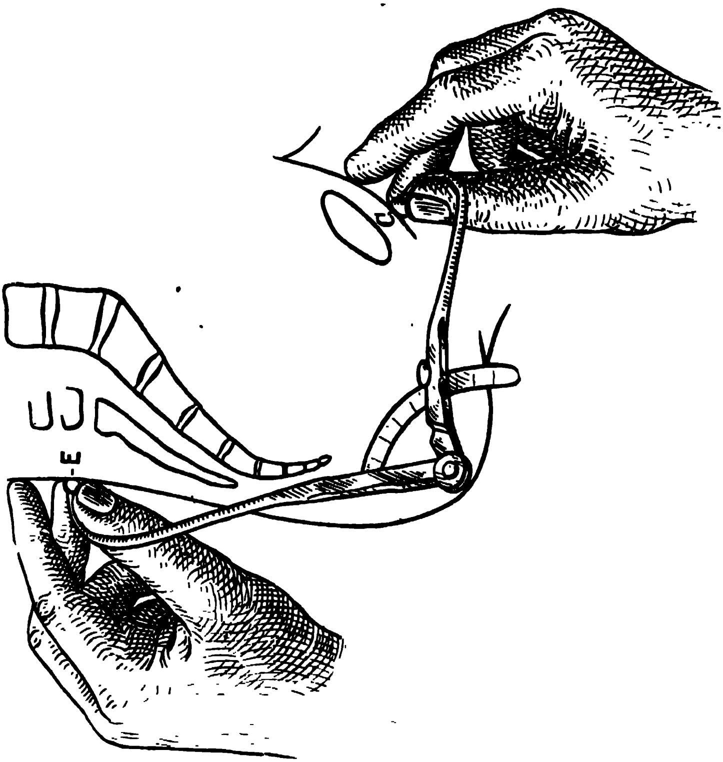

FIG. 118.—EXTERNAL PELVIMETRY: MEASURING EXTERNAL CONJUGATE OF PELVIS.

E, Depression under spine of last lumbar vertebra; C, centre of symphysis.

the distance between them read off on the scale. To measure the external conjugate the patient lies on her side with her back turned towards the operator. The instrument is held as before, and one limb is pressed firmly into the depression beneath the spine of the last lumbar vertebra, while the other is placed on the upper margin of the symphysis. If the depression below the lumbar spine cannot be found owing to excessive fat, its position may be determined by taking the middle of a line between the two pits which mark the posterior superior spines, and then *measuring a centimetre upwards* (Credé), or by taking a point in the middle line three to four centimetres below the level of the iliac crests (Spiegelberg). (3)To measure the distance between the posterior superior spines, the patient lies on her side or on her face, and the tips of the pelvimeter are applied to the depressions which mark the positions of the spine.(4)To measure the distance between the tubera ischii, the patient must be placed in the lithotomy position, the positions of the inner margin of the tuberosities of the ischium are marked with a pencil on the skin overlying them, and the distance between them measured with a tape measure. To the result one to two centimetres (0·4 to 0·8

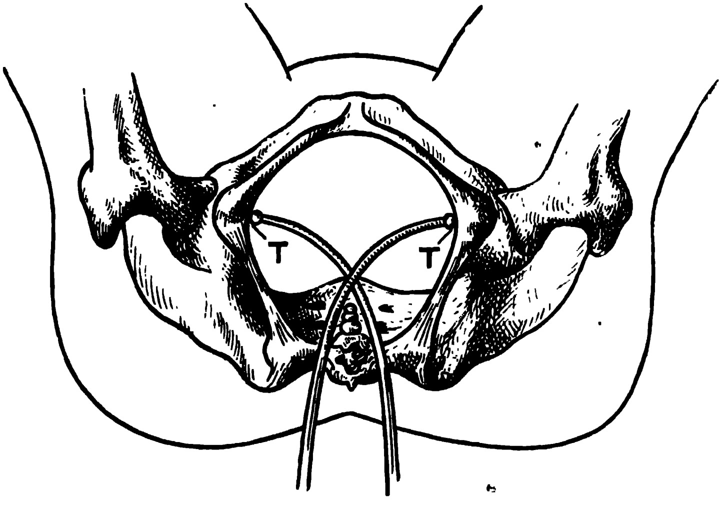

FIG. 119.—EXTERNAL PELVIMETRY: MEASURING TRANSVERSE DIAMETER OF OUTLET.

TT', Inner margins of tubera ischii.

inch) must be added to make up for the thickness of the soft parts. Another method consists in palpating the inner margin of the tubera ischii with the thumbs, and then so placing the latter that the nails are directly over the points to be measured (Frankenhäuser). An assistant then ascertains the distance between the nails with a pelvimeter with the blades crossed (*v.* Fig. 119).(6)To measure the antero-posterior diameter of the outlet, the patient is placed on her side with her back towards the operator. The position of the sacro-coccygeal joint is determined by passing the index finger into the vagina and palpating the intervening tissue between it and the thumb placed over the termination of the sacrum externally. One terminal of the pelvimeter is then placed on this point, and the other on the sub-pubic ligament of the symphysis (*v.* Fig. 120). From the measurement thus obtained a deduction of one to one and a half centimetres (0·4 to 0·6 inch) must be made to compensate for the thickness of the sacro-coccygeal joint (Breisky).*

The value of the measurements obtained in this manner for diagnostic purposes is not very great, as will be presently seen. Still, in certain cases they are of assistance, and should be made.

INTERNAL PELVIMETRY.—The measurements of the internal diameters of the pelvis are very much more important than are those of the external, as they furnish us with an exact plan of the size of the canal through which the fœtus has to pass; they are, however, at the same time, very much more difficult to determine correctly. The important diameters are the true conjugate and the transverse diameter of the brim. The oblique conjugate is only measured for the purpose of obtaining a basis from which to estimate the true conjugate.

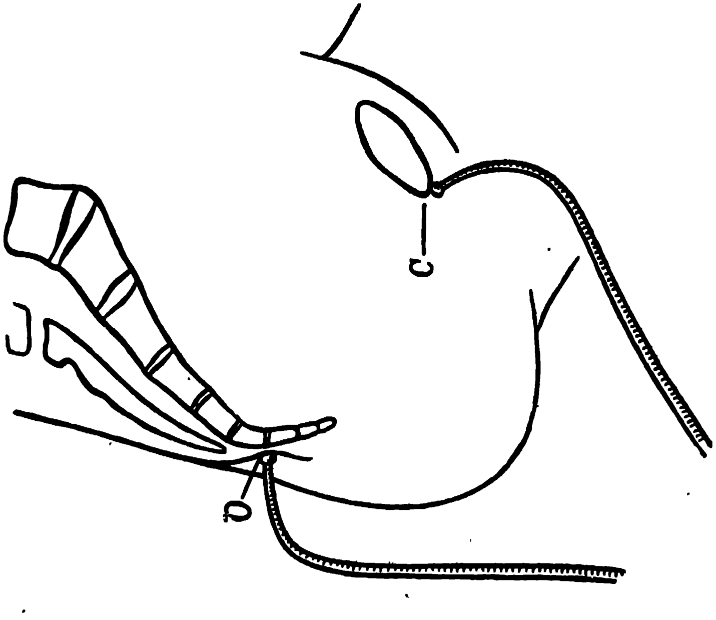

FIG. 120. – EXTERNAL PELVIMETRY: MEASURING ANTERO-POSTERIOR DIAMETER OF OUTLET.

O, Sacro-coccygeal joint; C, lower margin of symphysis.

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* *Wien. Med. Jahrbuch*, 1870, Part I., p. 3.

There are three methods of ascertaining the length of the true conjugate:—

(1) By direct measurement with the fingers.
(2) By measuring the oblique conjugate with the fingers and then estimating the true conjugate from it.
(3) By direct measurement with an internal pelvimeter.

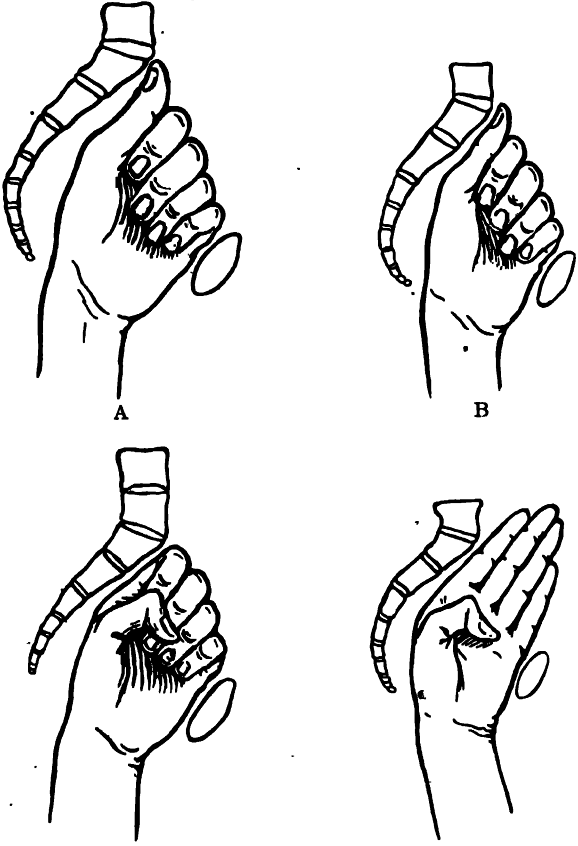

FIG. 121.—INTERNAL PELVIMETRY: JOHNSON'S METHOD.

A, Conjugate, measuring four inches; B, conjugate, measuring three and a half inches; C, conjugate, measuring three and a quarter inches; D, conjugate, measuring three inches. (These measurements are those of a man's hand of average size.)

Direct Measurement with the Fingers.—This method was introduced so long ago as the eighteenth century by Johnson,* but as it can only be practised after delivery—*i.e.*, when the vaginal walls are very lax, or in cases of great antero-posterior narrowing of the pelvis—its value is not very great. For this reason, it is not necessary to describe it at any length. Shortly stated, it consists in so arranging the fingers and thumb of one hand that they will just fill the space between the promontory of the sacrum and the symphysis, and then in measuring the width of the hand in such a position* (*v.* Fig. 121).

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* 'A System of Midwifery,' by R. W. Johnson, London, 1769.

Indirect Measurement with the Fingers.—This method consists in first measuring the oblique conjugate as will be described, and then, after making certain necessary allowances, estimating from this the length of the true conjugate. It is a method of value when practised by an expert who has had considerable experience; but, in view of the difficulty of making correct allowances for the various factors which have to be taken into consideration, it does not yield very reliable results in the hands of a comparatively unskilled person. To measure the oblique conjugate, the patient is placed in the dorsal position with her buttocks slightly raised by means of a pillow placed beneath them. The index and middle fingers are then introduced into the vagina and passed upwards until the promontory is reached. The first step consists in ascertaining whether there is a false promontory or not, as, in certain cases, a false lumbar promontory is formed at the junction of the fourth and fifth lumbar vertebræ, or a false sacral promontory at the junction of the first and second pieces of the sacrum (*v.* Fig. 122). The true promontory is readily recognised by the

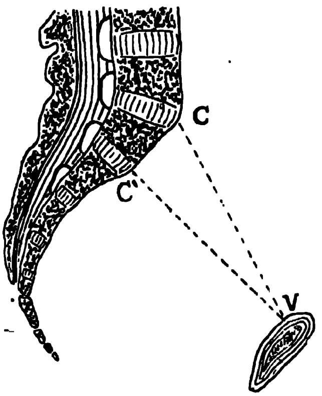

FIG. 122.—EFFECT OF FALSE PROMONTORY AT JUNCTION OF FIRST AND SECOND PIECES OF SACRUM, C', ON THE TRUE CONJUGATE DIAMETER C V.

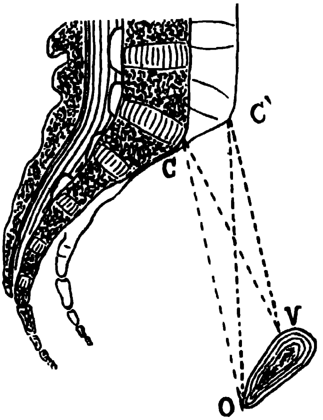

FIG. 123.—THE EFFECT OF THE HEIGHT OF THE PROMONTORY ON THE RELATION BETWEEN THE TRUE AND THE OBLIQUE CONJUGATE DIAMETERS.

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* A full description of Johnson's method will be found in Herman's work on 'Difficult Labour,' p. 176.

fact that the outline of the anterior margin of the base of the sacrum starts from it. In some forms of contracted pelvis, the distance between the false promontory and the symphysis may be less than the distance between the true promontory and the symphysis (Credé),* and, in such cases, the less diameter must be taken as representing the true conjugate, and our measurements made accordingly. Having ascertained the point from which the measurement is to be made, the tip of the middle finger is placed on it, and then the hand is raised until the sub-pubic ligament is in contact with its radial edge (*v.* Fig. 124). The spot at which the ligament crosses this edge is then marked, by making a small indent with the finger-nail, the hand is withdrawn, and the

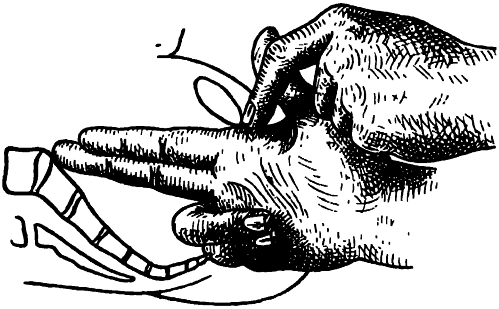

FIG. 124.—INTERNAL PELVIMETRY: MEASURING OBLIQUE CONJUGATE WITH THE FINGERS.

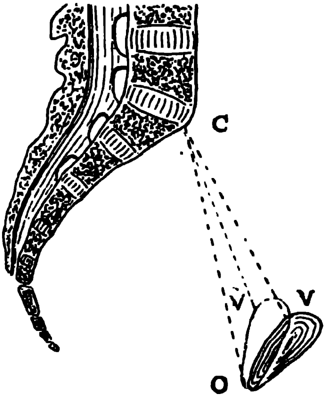

FIG. 125.—THE EFFECT OF THE INCLINATION OF THE SYMPHYSIS ON THE RELATION BETWEEN THE TRUE AND THE OBLIQUE CONJUGATE DIAMETERS.

* Credé, 'Klin. Vorträge über Geburtshülfe,' Berlin, 1853.

distance between the tip of the middle finger and the mark is measured. The measurement should be repeated a couple of times in order to ensure accuracy. If it is difficult to reach the promontory owing to its high situation, the elevation of the buttocks is slightly increased, and the patient is desired at the same time to press her lumbar spine firmly on to the bed. By this means the angle which the plane of the brim makes with the horizontal plane of the bed is increased, and the promontory is brought nearer to the examining finger (Schaeffer).*

Having in this manner ascertained the length of the oblique conjugate, the next thing is to estimate from it the true conjugate. As will be seen by reference to a diagram of a pelvis, the oblique

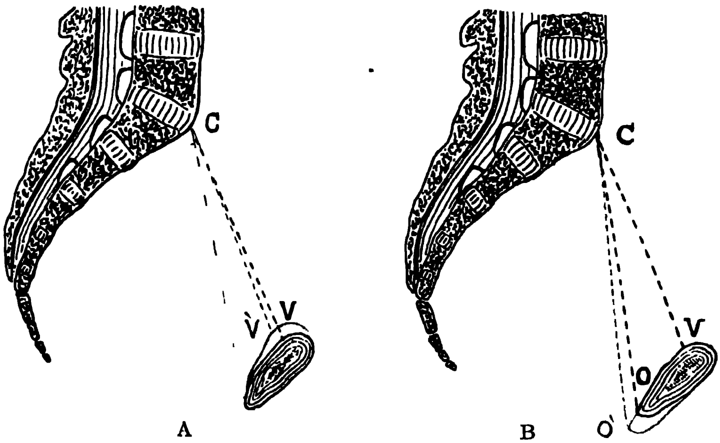

FIG. 126.—EFFECTS OF ALTERATIONS IN SYMYPHYSIS OF THICKNESS A), AND OF DEPTH (B) ON RELATION BETWEEN THE TRUE AND THE OBLIQUE CONJUGATE DIAMETERS.

conjugate in normal pelves is longer than the true conjugate. The average difference in normal pelves between the two is about half an inch; but, in contracted pelves, there are so many factors which affect the relation of these diameters to one another, that it is not sufficient to allow for an average difference, and an attempt must be made to judge what is the exact difference. This, however, is by no means any easy matter. Anyone can measure the oblique conjugate sufficiently correctly, but it requires considerable experience to enable one to attach a correct value to the various factors which alter the normal relations between it and the true conjugate. These various factors are as follows:—

(1) *The Height of the Promontory.*—The higher the promontory, the greater is the difference between the true and the oblique

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* Schaeffer, 'Obstetric Diagnosis and Treatment.' American edition, p 61.

conjugate; the lower the promontory, the less the difference (*v.* Fig. 123).

(2) *The Inclination of the Symphysis.*—The more vertical the symphysis, the greater is the difference between the two conjugates; the more horizontal the symphysis, the less the difference (*v.* Fig. 125).

(3) *The Depth of the Symphysis.*—The deeper the symphysis, the greater is the difference between the two conjugates; the shallower the symphysis, the less the difference (*v.* Fig. 126 B).

(4) *The Thickness of the Symphysis.*—The thicker the symphysis, the greater is the difference between the two conjugates; the thinner the symphysis, the less the difference (*v.* Fig. 126 A).

There is one point in favour of this method of estimating the true conjugate, and that is that in the form of contracted pelvis, in which it is most necessary to measure the true conjugate—viz., a flat pelvis—the average distance between the two conjugates is usually correct (Herman).* However, even if it is possible to measure the true conjugate correctly with the fingers, it is impossible to measure the transverse diameter of the brim. For this reason, we have usually to resort to the third method of performing internal pelvimetry—direct measurement with an internal pelvimeter.

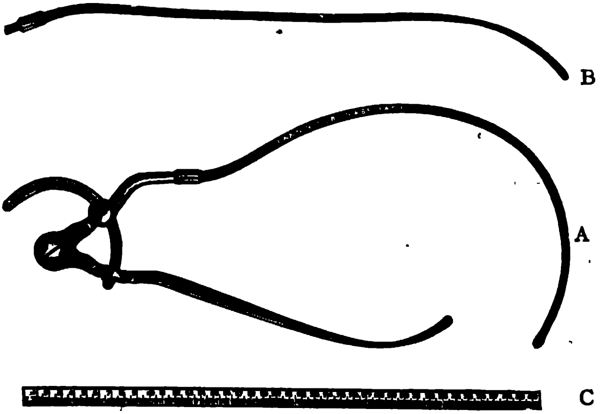

FIG. 127.—SKUTSCH'S INTERNAL PELVIMETER.
A, Complete pelvimeter; B, flexible limb; C, metal rule.

3. **Direct Measurement with an Internal Pelvimeter.**—This is the only reliable manner in which to measure all the required diameters of a contracted pelvis. If a little care is taken to master its details, it presents no difficulties, and after a little experience it will be found to give reliable results. It is curious that so many text-books on midwifery should either omit all

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* *Op. cit.*, p. 176.

mention of the method, or merely mention it as a form of obstetrical curiosity.

The best form of internal pelvimeter—indeed, the only form which, so far as we know, permits the measurement of the transverse diameter—is that devised by Skutsch.* This instrument consists of three parts:—(*a*) a rigid limb; (*b*) a flexible limb; (*c*) a movable connecting bar (*v.* Fig. 127). The two limbs interlock by means of an adjustable joint, which enables the rigid limb to be so placed that its convexity is either turned towards or away from the flexible limb. The connecting-bar is not graduated in any way; it merely serves as a means by which the limbs can be fixed in any desired relation to one another, and can be separated and returned to the same relation as required. In order to use the instrument, the patient is placed in the cross-bed dorsal position, or on a gynæcological couch. In most cases, an anæsthetic is required, as the procedure causes a certain amount of pain. A small patch of skin over the symphysis is then shaved, and a mark is made with a blue pencil over the centre of the symphysis. The principle on which Skutsch's mode of pelvimetry is based is a very simple one. In every case, the required diameter, plus the thickness of the pelvic wall and the superjacent soft parts at one end of the diameter, is first measured. Then the thickness of the included pelvic wall and soft parts are measured, and by deducting this result from the former, the actual measurement of the diameter is obtained. To measure

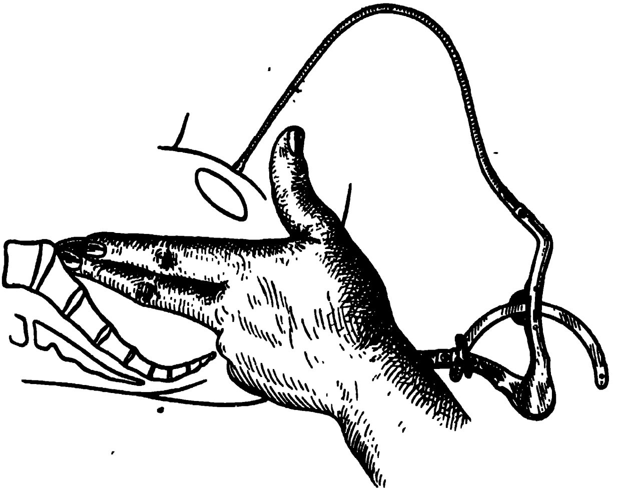

FIG. 128.—INTERNAL PELVIMETRY: MEASURING OBSTETRICAL CONJUGATE *plus* THICKNESS OF SYMPHYSIS AND SUPERJACENT SOFT PARTS.

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* 'Die Beckenmussen,' Jena, 1886; and 'Die Praktische Verwerthung der Beckenmussen,' *Deutsche Med. Woch.*, 1891, No. 21.

the true conjugate, the pelvimeter is first so arranged that the rigid limb curves away from the flexible limb, and then, by means of the movable connecting-bar, the limbs are so locked that they make an angle of about 60° with one another. The index and middle fingers of the left hand are then passed into the vagina, and upwards until the tip of the middle finger rests on the promontory. The rigid limb of the pelvimeter is passed into the vagina under the guidance of these fingers, and its tip brought to rest on the most projecting part of the promontory (*v.* Fig. 128.) The vaginal fingers hold it in this position with the external assistance of the other hand, while an assistant bends the flexible limb downwards until it just touches the mark, which was made over the centre of the symphysis. The instrument is then carefully withdrawn, and the distance between the ends measured with

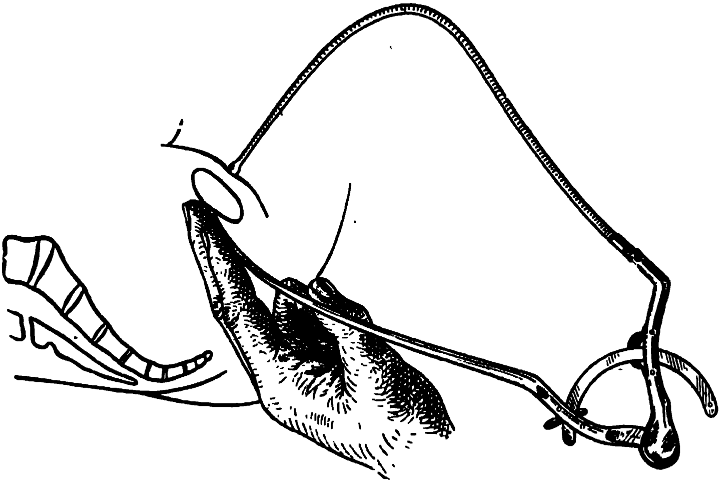

FIG. 129.—INTERNAL PELVIMETRY: MEASURING THICKNESS OF SYMPHYSIS AND SUPERJACENT SOFT PARTS.

the metal rule, and noted. The position of the rigid limb is then altered, so that it curves towards the flexible limb, the fingers of the left hand are again passed into the vagina, and the back of the symphysis carefully palpated with the object of determining its most projecting part. The tip of the rigid limb is then guided into the vagina, and rested against this point, and the flexible limb is again bent down until the tip just touches the marked spot (*v.* Fig. 129). As there is a certain amount of risk that the relations between the ends of the pelvimeter may be altered by the pressure of the soft parts during its withdrawal, it is well to open the thumbscrew which is at one end of the connecting-bar, and then to separate the limbs as far as is necessary. As soon as the instrument has been taken out of the vagina, the limbs are brought back into their original position—a procedure which is rendered possible by the presence of a small collar at one end of the connecting-bar, which acts as a check to the range of movement of the limbs, and the distance between the tips is measured. This distance is then subtracted from the first measured distance, and the result is the length of the true conjugate diameter.

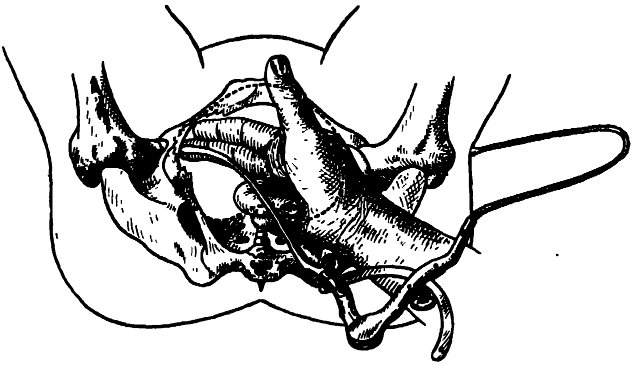

FIG 130.—INTERNAL PELVIMETRY: MEASURING TRANSVERSE DIAMETER OF BRIM *plus* THICKNESS OF LATERAL WALL OF PELVIS AND SUPERJACENT SOFT PARTS.

To measure the transverse diameter, a mark is made over one or other great trochanter, and the pelvimeter is so adjusted that the rigid limb curves away from the flexible limb. If the mark has been made over the left trochanter, the fingers of the right hand are passed into the vagina, and the right lateral half of the

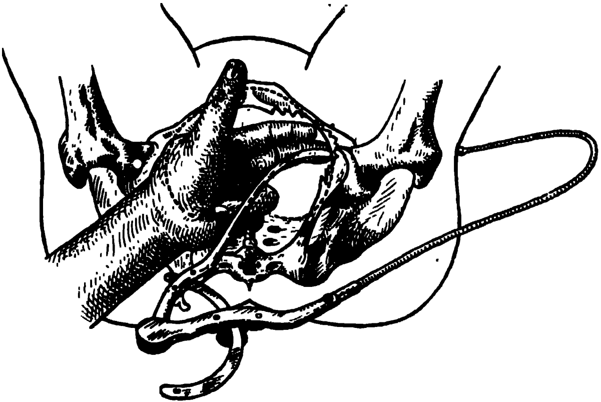

FIG. 131.—INTERNAL PELVIMETRY: MEASURING THICKNESS OF LATERAL WALL OF PELVIS AND SUPERJACENT SOFT PARTS.

brim of the pelvis is carefully palpated with the object of ascertaining the starting-point on that side of the transverse diameter. The tip of the rigid limb is then guided on to this point and held there, while an assistant bends down the flexible limb until the tip rests upon the mark over the trochanter (*v.* Fig. 130). The instrument is then carefully withdrawn, and the distance between the tips measured. The rigid limb is then reversed, the left fingers are passed into the vagina, and the left half of the pelvic brim is palpated as before, and with the same object. The tip of the rigid limb is then guided on to the left end of the transverse diameter, and the flexible limb bent downwards again on to the mark (*v.* Fig. 131). The instrument must be opened to permit of its withdrawal, and, after removal and closure, the distance between the tips is measured. This distance is subtracted from the former measurement, and the result is the length of the transverse diameter.

Both diameters should be measured two or three times until a satisfactory result is arrived at. In the case of the transverse diameter, it is well to measure first from one trochanter, and then from the other, as in this way an additional check on the measurement is obtained. There are three points which must be carefully attended to in using Skutsch's pelvimeter. These are:—

(*a*) To ascertain the correct terminations of the different diameters by careful preliminary internal examination of the pelvic brim.

(*b*) To bring the end of the rigid limb to rest exactly on these spots, and to keep it there while the external limb is being adjusted.

(*c*) To see that the assistant places the end of the flexible limb exactly on the external mark in each case, and that the end always presses on the skin with the same degree of force. The latter point will be best obtained by always bringing the tip down so that it just touches the skin without dimpling it.

PART III

THE PHYSIOLOGY OF PREGNANCY

CHAPTER I

THE MATERNAL PHENOMENA OF PREGNANCY

Duration of Pregnancy—The Phenomena of Pregnancy. Changes in the Uterus; in the Cervix; in the Fallopian Tubes and Ovaries; in the Vagina and Vulva; in the Pelvic Floor; in the Abdominal Wall; in the Bladder and Rectum; in the other Abdominal Organs; in the Thorax; in the Breasts; in the Face and Limbs; in the Pelvic Joints: Systemic Changes, Circulatory System, Respiratory System, Urinary System, Digestive System, Osseous System.

PREGNANCY is the term applied to the condition of a woman when she contains within her the products of conception. It commences with the fertilisation of the ovum, and ends with its expulsion. It is customary to consider that the duration of pregnancy is ten lunar months of four weeks each, or 280 days, counting from the first day of the last menstruation. In practice, however, we find that considerable divergence from this period is often met with. When we consider the various factors associated with the occurrence of conception, this divergence is easily understood. The chief of these factors are the time at which the fertilising coitus takes place, the preparedness of the uterus for the reception of the fertilised ovum, and the time at which ovulation takes place. The human species differs from animals in that in the human female there is no period of sexual inactivity, consequently the fertilising coitus may occur at any time in relation to menstruation, save when menstruation is actually taking place. Similarly, the uterus is apparently always in a favourable condition for the reception of the impregnated ovum at all times save when menstruation is occurring. Ovulation, on the other hand, is considered to occur most usually during the week before or the week after menstruation, on account of the attendant congestion of the generative organs. Consequently, it is probable that the most favourable time for impregnation to occur is in the week preceding or the week following a menstrual period (Giles). In practice, however, even if the date of the fertilising coitus is known, it is difficult to determine when delivery will occur. The following table of Reid's, based on the results of forty cases in which only a single coitus took place, shows the truth of this:—

Number of Cases.	Duration of Pregnancy in Days.	Percentage.
5	260-266	12·5
7	267-273	17·5
18	274-280	45·0
6	281-287	15·0
4	288-294	10·0

The results which are obtained by counting from the date of the last menstruation are not much more satisfactory. The following table shows the results in 650 cases collected by Merriman and Reid. In each case pregnancy is calculated from the final day of the last menstruation :—

Number of Cases.	Duration of Pregnancy in Days.	Percentage.
28	253-259	4·30
64	260-266	9·84
102	267-273	15·69
177	274-280	27 23
140	281-287	21·53
81	288-294	12·46
39	295-301	6 00
13	302-308	2·00
6	309-315	0·92

The average duration of pregnancy, calculated from a large series of cases, and counting from the final day of the last menstruation, is 277 days. Between that period and a period of 280 days, counting from the first day of the last menstruation, there is not much difference, and the former is the more easy to remember.

THE PHENOMENA OF PREGNANCY

From the commencement of pregnancy many pronounced changes begin to occur in the maternal system, affecting more particularly the reproductive organs, and also to a less extent almost every other organ in the body. Many of these changes are the direct result of the increased blood-supply which the pelvic viscera receive, and of the mechanical effects exercised upon neighbouring parts by the growing uterus; others must be associated with the necessity of supplying the enlarging ovum with oxygen and nutritive material; while still others cannot be referred to any of these causes, and must be classed as signs of the profound physiological alteration which has occurred in the entire organism. The changes will be considered seriatim.

The Uterus.—The anatomical changes which take place are more marked in this organ than in any other, since it must rapidly enlarge to provide an adequate receptacle for the ovum. The entire extent of the change which occurs can best be appreciated by comparing the weight and capacity of the viscus when in the pregnant and non-pregnant condition. The weight of the unimpregnated virgin uterus is about an ounce; that of the uterus at term is about two pounds, or thirty-two times as heavy. The capacity at term is increased even out of proportion to this, being from 4,000 c.c. to 5,000 c.c., or nearly five hundred times as great as in the virgin.

All the tissues of the uterus share in this hypertrophy. The mucous membrane becomes softer and thicker, attaining a thickness of about half an inch at the fifth month; the glands become elongated, tortuous, and very much dilated; and at the same time the important changes which were described in discussing the formation of the placenta* are brought about in the blood-supply. The muscular tissue in the earlier months undergoes an enormous hypertrophy, so that, in spite of the rapid increase in size of the entire organ, its walls still maintain their original thickness. At first, the uterus grows more rapidly than the fœtus, but in the later months the ovum increases in size out of proportion to the uterus, and some slight degree of thinning of the uterine walls then takes place as a result of the distension. The increase in the muscular tissue is partially due to increase in size of the individual fibres, and partly to the development of new fibres (*v.* Fig. 132). Scattered amid the fibres of the non-gravid uterus are found a large number of embryonic cells, which, under the stimulus of pregnancy, become developed into true muscular fibres, and these, as well as what may be termed the permanent muscle fibres, attain an enormous degree of development, becoming often ten times as large as an ordinary unstriped muscle cell. The connective tissue undergoes hypertrophy *pari passu* with the muscular tissue, and thus enables the various layers of the muscular coat to be more easily demonstrated—in fact, it is principally in the walls of the gravid uterus that these layers have been described. The hypertrophy of the muscle elements at first takes place throughout the entire uterus, but, after the third month, the body and fundus alone show signs of increase, the cervix having at that time reached its maximum development. The peritoneum covering the uterus also shares in the general hypertrophy, and, instead of becoming thinner, shows signs of thickening, at any rate in the earlier months. The connective tissue immediately subjacent to it also becomes thicker over the lower portion of the uterus, and especially in front. Over the fundus and back, however, the serous coat remains very closely adherent to the muscular wall.

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* For further details concerning formation and fate of decidua, see page 83.

3 The uterine and ovarian arteries, but especially the former, become elongated, their lumen greatly increased in size, and their coats thicker. The increase in size is most pronounced in the branches which are distributed over the placental site. The branches, which have been described as passing vertically inwards, assume a spiral form, and, together with the veins, are subject to compression during contraction of the uterus, owing to the manner in which the fibres of the middle layer of the muscular coat surround them. The veins also become dilated, particularly in the neighbourhood of the placental site. Commencing in the maternal blood sinuses of the placenta, they pass into the uterine wall, where they form what are known as the uterine sinuses. These sinuses are large venous spaces, whose wall is practically formed by the uterine tissue, a thin layer of endothelium alone intervening. From these, the veins pass into the broad ligament, from which the blood is carried off by the uterine and ovarian veins. The ovarian veins are enormously distended, especially on the left side,* where this vessel may attain a diameter almost equal to that of the femoral vein. The uterine veins are also

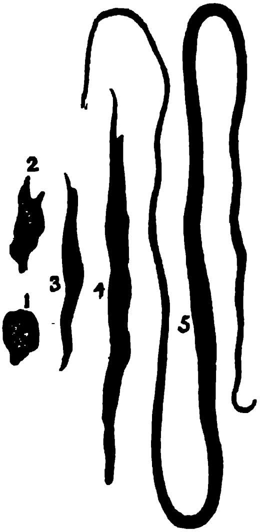

FIG. 132.—UTERINE MUSCLE FIBRES.
1, 2, Embryonic muscle fibres of non-pregnant uterus; 3, 4, 5, muscle fibres from pregnant uterus. (Galabin.)

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* This is irrespective of the position of the placenta.

distended, but appear to drain away less of the blood from the uterus than the ovarian veins. This is probably due to the large development of the fundus uteri, and to the usually high position of the placenta.

The lymphatics of the uterine wall increase in number and size, and probably play an important part in providing for the nutrition and excretion of the fœtus before the formation of the placental circulation.

The nerves also enlarge, and the ganglion cervicis is said to become almost double its former size.

In the first three months of pregnancy, the increase in size of the uterus affects its breadth and thickness more than its length, so that the globular shape which it gradually assumes becomes an important sign in the early diagnosis of pregnancy, and can readily be detected by bi-manual examination. The increased weight of the uterus causes it at the same time to sink a little deeper in the pelvis, and brings about an exaggeration of its normal degree of anteflexion. This sinking occasionally causes disagreeable pressure symptoms in the first period of gestation by

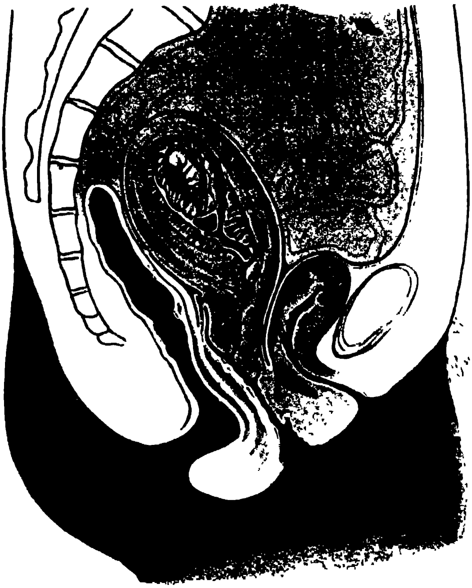

FIG. 133.—SAGITTAL MESIAL SECTION OF A PATIENT WHO DIED IN THE SECOND MONTH OF PREGNANCY.

The body of the uterus is retroflected, and if the patient had lived incarceration might have occurred. (Braune.)

pressing on the bladder and rectum, and upon the veins of the latter. It may also cause a retro-deviated uterus to pass more deeply into the concavity of the sacrum, thereby increasing the subsequent difficulty in clearing the sacral promontory. This sinking also causes the abdominal wall just above the symphysis to become rather flatter during the first couple of months after conception than it is at other times.

About the commencement of the fourth month, the fundus of the uterus reaches the level of the pelvic brim, and from that time on it gradually ascends higher and higher into the abdomen. The globular shape is retained until the sixth month, but, after that date, the rapid growth of the ovum causes the latter to assume a position in the uterus with its long axis corresponding to the vertical axis of that viscus. In this way, the uterus is made to assume an ovoid shape, the broad end of which is formed by the fundus, and the narrow end of which is situated at the junction of the body with the cervix.

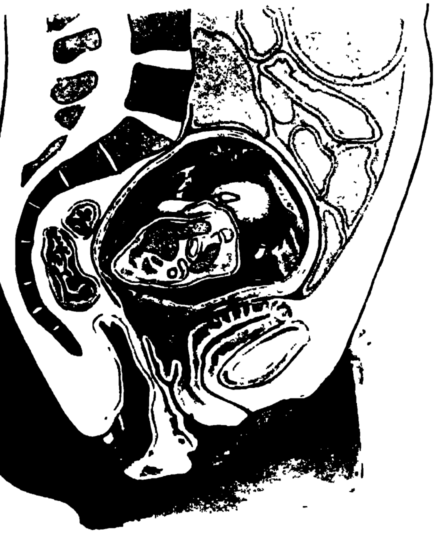

FIG. 134.—SAGITTAL MESIAL SECTION OF A PRIMIPARA WHO DIED DURING THE FOURTH MONTH OF PREGNANCY. (Waldeyer.)

As the uterus ascends into the abdomen, it over-rides the lower part of the mesentery proper, and ultimately flattens out the entire mesentery against the posterior abdominal wall, driving the small intestine over to the left, and upwards beneath the transverse meso-colon. The uterus itself, as a result of the position of the small intestines, almost invariably inclines towards the right, and lies in contact with the right antero-lateral wall of the abdomen. In addition to this obliquity, its long axis frequently shows also a marked rotation to the right, which brings its left margin in contact with the anterior abdominal wall, and its right margin into relation with the front of the right kidney and ascending colon. Sometimes, but very rarely, the uterus occupies a median position, or is inclined to the left, and a rotation of its long axis to the left has also been described.

Owing to the pelvic inclination, the uterus is directed forwards as it passes into the abdomen, and therefore in the erect position is largely supported by the anterior abdominal wall and by the symphysis pubis. In the recumbent position, though retaining its anteversion, it becomes retroflexed, and is supported by the structures on the posterior abdominal wall. When relaxed, its weight causes it to become flattened from before backwards and to bulge out at the sides, and it then becomes impressed by the various viscera with which it is in contact. It must be remembered, however, that, during pregnancy, the uterus is constantly undergoing a series of slow contractions, and that, consequently, its form is but little dependent on the pressure of surrounding structures.

According to Sutugin[*] and Galabin,[†] the following is the average height of the uterus above the pubes at the different months:—

Week of pregnancy	16,	18,	20,	22,	24,	26,	28,	30,	32,	34,	36,	38,	40.
Height of uterus in inches	4·0,	4·7,	5·4,	6·0,	6·6,	7 3,	7·8,	8·3,	8·7,	9·0,	9·3,	9·6,	10 0.

One point will immediately strike the reader in this table, namely, that there is no decrease shown in the height of the uterus above the pubis at the end of the tenth month. This is accounted for by Galabin on the ground that these measurements were taken with the patient in the horizontal position, and that the sinking of the fundus is only appreciable when the patient is in the erect position.

The Cervix.—The changes which take place in the cervix uteri during pregnancy have for long been the subject of controversy, and as many points have not yet been definitely decided upon, it is unnecessary here to enter at any length into a discussion of the matter, more especially since some of the points at issue are merely verbal ones. The alterations that take place will be dealt with under three headings:—

(1) Changes in position.
(2) Changes in consistence.
(3) Changes in length.

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[*] 'On the Means of Ascertaining the Length of Gestation,' etc., *Obstet. Journ. of Great Britain and Ireland*, vol. iii., 1875.

[†] *Op. cit.*, p. 141.

(1) *Changes in Position*:—Associated with the general descent of the uterus, the cervix descends somewhat during the first three months of pregnancy, and is felt at a lower level than normal within the vagina, and projecting slightly forwards. After the end of the third month, it is gradually drawn upwards by the ascending uterus, and sometimes to such an extent that difficulty may be experienced in detecting it by vaginal examination. The anteversion which is normally present becomes changed into retroversion, and often the long axis of the cervix forms a well-marked angle, open forwards, with the axis of the body of the uterus.

(2) *Changes in Consistence*:—From the end of the first month, a well-marked change in the consistence of the cervix can be detected by the examining finger, and forms an important diagnostic sign. The most superficial portion of the lips of the os externum first become soft and œdematous, due to the vascular and lymphatic hypertrophy, and to an outpouring of serous fluid from the enlarged bloodvessels. This softening gradually extends to the deeper parts of the cervix, till at the end of the third month the whole of the infravaginal portion is thus altered. During the succeeding months, the change extends upwards; and, finally, at the end of pregnancy the whole cervix—unless it be the seat of pathological change—has become soft and dilatable. The softening in the region of the os externum enables the finger to be more readily passed between its lips into its cavity, and gives an impression as if the orifice itself were circular.

(3) *Changes in Length*:—Until comparatively recently it was taught that the upper portion of the cavity of the cervix became gradually distended during pregnancy from above downwards to form the lower uterine segment, and that this method of inclusion accounted for the shortening of the cervix which was believed to occur. This view, in spite of some opposition, was held till the middle of the last century; and most books on midwifery gave definite details as to the amount of shortening which one might expect to find at the different months of pregnancy. However, since then several observers—chief among whom in this country was Matthews Duncan*—have affirmed that no taking up of the cervix occurs till a very short period before the onset of labour, and that, instead of being shortened, the cervix is actually lengthened. This opinion is now generally believed to be the correct one, and is arrived at from the result of actual measurements of the cervix made during dissections of uteri at the different months. It was, however, strongly combated by Bandl,† who, from a study of a series of sections and specimens, re-annunciated in 1877 the old view in a slightly modified form.

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* G. Matthews Duncan, 'On the Cervix Uteri in Pregnancy,' *Edinburgh Medical Journal*, 1859.

† Bandl, L., 'Ueber das Verhalten des Uterus und Cervix in der Schwangenschaft und während der Geburt.' Stuttgart.

He stated it to be his belief that the upper portion of the cervix did open out, and that the prominent ring, which may sometimes be felt in the uterine wall during labour above the symphysis pubis, represented the os internum. One chief obstacle to accepting his views is that the lower part of the uterine cavity is lined with decidua, but this he explained by stating that it grows down from the body of the uterus, and displaces the cervical mucous membrane before it into the closed part of the cervix. Since the publication of Bandl's papers a considerable amount of investigation has been carried out, and the fact that no taking up of the cervical canal occurs has been demonstrated by a number of observers. The ring to which Bandl called attention, and which is sometimes known by his name, un-

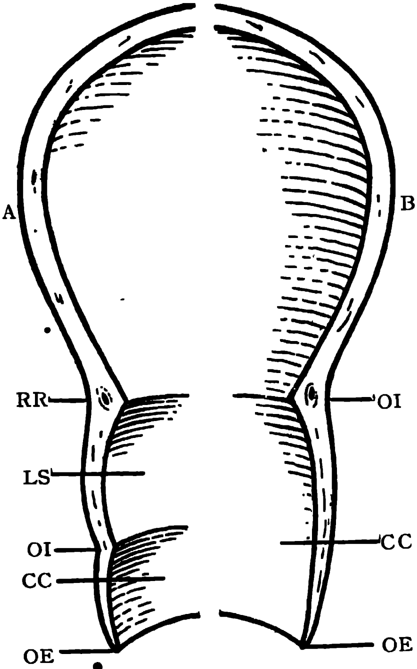

FIG. 135.—DIAGRAM SHOWING THE TWO VIEWS HELD REGARDING THE FORMATION OF THE LOWER UTERINE SEGMENT.

The left-hand diagram (A) represents the view generally received, according to which the retraction ring marks the junction between the upper and lower uterine segment and does not correspond with the inner os. The right-hand diagram (B) represents the views held by Bandl, according to which the inner os and Bandl's ring coincide, and the lower segment is formed out of the taken-up cervix. RR, retraction ring; CC, cervical cavity; LS, lower uterine segment; OI, os internum; OE, os externum. (After Dickinson.)

doubtedly does not represent the os internum, but is the line of separation which marks off the upper contractile from the lower non-contractile segment of the corpus uteri. It cannot be clearly seen in the uterus after death, and is evidently produced by the contraction and retraction which occurs during labour. The walls of the uterus before the onset of labour are of practically the same thickness from the fundus down to the level of the closed cervix, where a sudden increase in thickness takes place. Externally, there is a sharp line of demarcation visible and palpable between the cervix and the body; and above this level no other ring can be seen, with the exception of a faint constriction on the anterior wall, corresponding to the line of reflection of the peritoneum on to the symphysis pubis. This ring is therefore non-existent before labour commences, and must be regarded as being produced within the body of the uterus itself, as a result of the peculiar mode in which the corpus uteri contracts. That the cervix is really lengthened has also been amply demonstrated; and the apparent shortening which is felt by the finger when making a vaginal examination may be explained as follows:—(*a*) The softening of the cervical tissues permits the finger to compress them, and to enter for a short distance through the os externum, which has

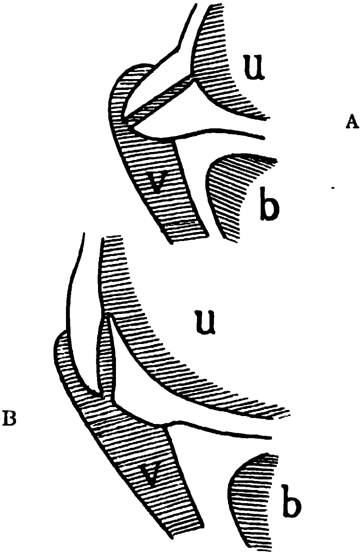

FIG. 136.—DIAGRAM SHOWING DIRECTION OF CERVICAL AXIS BEFORE (A) AND (B) DURING PREGNANCY.

u, Uterus; *v*, vagina; *b*, bladder. (Galabin.)

become somewhat patulous. (*b*) The vaginal wall has become softened and œdematous at its uterine attachment, and this, combined with the gradual ascent of the cervix, which ascent occurs from the fourth month onwards, causes the projection of the portio vaginalis into the vagina to feel and to be really shorter, without any change having taken place in the length of the cervix as a whole. (*c*) The downward bulging of the cavity of the uterus in front of the cervix as a result of the pressure of the fœtal head, together with a forward inclination of the cervix from above downwards, render the apparent shortening of the anterior lip and cervical wall particularly noticeable, inasmuch as these conditions cause the vertical distance between the uterine cavity and the os externum to be really lessened. The forward inclination of the cervix, in fact, causes the examining finger to be separated from the cavity of the uterus by the antero-posterior thickness, and not by the length of the cervix (*v.* Fig. 136).

Fallopian Tubes and Ovaries.—The Fallopian tubes participate in the hypertrophy of the uterus, becoming longer and wider. They lie closely applied to the uterine wall, and their direction is altered so that their long axis becomes almost vertical. The ovaries lie immediately external and posterior to the tubes, and are also closely related to the side of the uterus. Their level in the abdominal cavity is about that of the anterior spines of the ilia. In consequence of the axial rotation of the uterus, the left ovary is brought forwards into contact with the anterior abdominal wall, and the right lies posteriorly in contact with the cæcum. Both ovaries are enlarged, and contain true corpora lutea.

Ligaments and Peritoneal Reflections of Uterus. — Reference has already been made to the hypertrophy of the serous coat of the uterus, and we have now only to consider its reflections off the uterus. On the posterior aspect, the level of reflection of the peritoneum on to the rectum remains unchanged, and is opposite the fifth sacral vertebra. Anteriorly, however, it is considerably raised, and in the later months of pregnancy passes directly from the front of the uterus, over the top of the bladder, to the back of the symphysis pubis about its middle, thus substituting a utero-pubic for the normal utero-vesical pouch. The broad ligaments also are raised. As the uterus expands upwards and laterally, it increases the tension upon these ligaments, and at the same time burrows out between their folds. The upper attachment of the ligaments to the uterus remains the same as before, but their lower attachment is displaced upwards to the iliac fossæ. Ultimately, they assume an elongated triangular shape, the apex being situated at the junction of the Fallopian tubes with the uterus, and the base in the iliac fossæ, where the folds which constitute the ligaments pass forwards and backwards, in continuity with the peritoneum lining the fossæ.

The intra-abdominal portions of the round ligaments are very much thickened. Superiorly, they appear attached to the anterior rather than the lateral aspect of the uterus, in consequence of the lateral expansion of that viscus. From their uterine attachment, they pursue an almost vertical course downwards parallel and internal to the Fallopian tubes, and are closely bound to the uterus till just before they reach the internal abdominal ring. No increase in size of these ligaments is found within the inguinal canal. Their enlargement within the abdomen enables them from their attachment below to draw the fundus uteri forwards, and bring the long axis of the uterus more into a line with the axis of the pelvic brim during labour.

5 **The Vagina and Vulva.**—During the early months of pregnancy the vagina becomes wider and shorter in consequence of the sinking of the uterus; but the subsequent ascent of the latter exerts an upward pull upon the vagina, which, consequently, from the end of the third month becomes longer and narrower than normal. The muscular tissue of its wall hypertrophies, and the mucous membrane becomes thicker, more relaxed, and of a bluish colour. This colour is the expression of the venous engorgement of the vaginal walls, brought about by the intra-abdominal pressure, and by the enormous hypertrophy and dilatation of the veins of the vaginal plexus. The mucous membrane of the vulva also becomes softer and relaxed, and the vulvar orifice widened. Some dilatation and hypertrophy of the superficial veins occur, but little change is noticeable in the erectile tissue proper. The connective tissue surrounding both vulva and vagina becomes increased in amount and softened, and a similar change occurs throughout the whole of the pelvic cellular tissue.

6 **Pelvic Floor.**—The pelvic floor, in common with the abdominal wall, shows the increased pressure which is thrown upon it during pregnancy by an increased projection beyond the plane of the pelvic outlet. In the non-pregnant, this projection is about an inch (2·5 centimetres); at the end of pregnancy it is about 3¾ inches (9·5 centimetres). The distance from the coccyx to the symphysis, measured along the surface, is correspondingly increased. In the non-pregnant, this distance is about 5⅖ inches (13·5 centimetres), and, at the end of pregnancy, it reaches as much as 10⅕ inches (25·5 centimetres). The muscles of the pelvic diaphragm (*levator ani* and *coccygeus*) do not present any hypertrophy, but all the involuntary muscular tissue within the pelvis is increased. The obliterated hypogastric arteries hypertrophy, and bands of unstriped muscle extend from their upper and lower margins on to the antero-lateral aspect of the uterus, forming a somewhat hammock-like support around the lower uterine segment.

7 **Abdominal Wall.**—The first change noticed in the abdominal wall as a result of pregnancy is slight flattening just above the symphysis pubis, brought about by the primary downward sinking of the uterus and its contents. 2 Before, however, the

uterus actually extends into the abdominal cavity, evidence of the increased abdominal content is seen in a gradually increasing protuberance of the abdominal wall. The exact amount of this protuberance depends on the period of pregnancy, and varies with the form of the individual. 3 The umbilical scar becomes gradually raised up, and reaches the level of the surrounding skin at the sixth or seventh month. Later, it becomes completely everted, and projects above the general surface, surrounded by a pigmented area of skin, which has been called by Montgomery[*] the 'umbilical areola.' 4 A pigmented line of a brownish colour—the depth of hue varying with the complexion of the individual—also forms between the umbilicus and pubes. It is usually broader below than above, and may extend above the umbilicus as far as the ensiform cartilage. It fades considerably after delivery, but traces of it frequently remain permanent. 5 In some cases, the pressure on the anterior abdominal wall causes wide separation of the recti muscles, and, if the uterus is unusually anteflexed, it may even form a hernial protrusion between their inner borders.

The stretching of the abdominal wall affects the nutrition of the skin, and in the later months of pregnancy pinkish or bluish marks—the lineæ atrophicæ, or striæ gravidarum—make their appearance principally on the lateral aspect of the lower portion of the abdomen. The lines are usually curved, with their concavity inwards, and are broader at the centre than at either end. After delivery, they assume a white colour, and are slightly depressed below the level of the surrounding skin. Similar marks may appear upon the outer aspect of the thighs in their upper part.

Bladder and Rectum.—As the uterus ascends into the abdomen, the peritoneum is gradually stripped off the posterior and superior surfaces of the bladder, so that this viscus in the later months becomes entirely stripped of peritoneum. Its capacity is diminished, and when empty it is found flattened out between the lower segment of the uterus and the back of the symphysis, and is triangular in shape. The apex is directed upwards, lying at a point about half an inch below the upper margin of the symphysis; the base is directed downwards, and rests on the anterior vaginal wall, just in front of the utero-vaginal junction. The bladder walls are slightly thickened. The ureters enter the bladder on each side of its base. Within the pelvis, the relations of the ureter are quite unaltered, and it is in no way subjected to injurious pressure. In the abdomen, however, the right ureter is compressed between the relaxed uterus and the right psoas muscle when the patient is in the recumbent position. It would appear as if the yielding nature of both these structures would render this pressure practically ineffectual, but that this is not the case is proved by the fact that the right ureter is dilated during pregnancy. Within the pelvis, both ureters are hypertrophied. They become round and cord-like, with greatly thickened walls, and in the terminal part of their course can readily be felt and compressed against the ramus of the pubis by the finger when making a vaginal examination.

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[*] Montgomery, 'Signs and Symptoms of Pregnancy,' p. 96, 1856.

1 Owing to the forward bending of the uterus and the obliquity of the pelvic brim, very little direct pressure is exerted upon the rectum. The deviation of the uterus to the right side, moreover, causes the pelvic and iliac colon to escape, so that, except under abnormal conditions, no obstruction of the lower bowel can occur from pressure. Evidence of the general venous congestion of the pelvic organs is, however, seen in the rectum in the frequent presence of hæmorrhoids.

9 **Other Abdominal Organs.**1—The position, which the intestines are compelled to take by the enlarging uterus, has already been referred to, and it may now be added that the transverse colon passes transversely across the upper margin of the full-term uterus. The transverse meso-colon is hollowed out to receive the fundus. 2 When in the recumbent posture, the uterus lies in direct contact with the lower portion of the anterior surface of the right kidney, and over this area the fatty capsule of the kidney is deficient — a fact which may partly account for the greater frequency of movable kidney on this side. This kidney also often occupies a slightly lower position than normal, due probably to the downward pressure of the liver. The left kidney and the suprarenal capsules are quite unaltered.

3 The vertical depth of the anterior part of the liver is diminished by the upward pressure of the uterus, which is only separated from it by the transverse meso-colon, and a compensatory increase in the vertical depth of the posterior part occurs, and possibly. tends to displace the right kidney downwards.

10 **The Thorax.**—The mechanical effects of the pressure of the enlarged uterus are not confined to the abdominal and pelvic cavities, but also affect to a somewhat variable extent the thoracic cavity. The vertical height of the latter is diminished in correspondence with the increased vertical height of the peritoneal cavity, and this change is most marked on the right side. In fact, the liver is pushed bodily upwards, and the right dome of the diaphragm often reaches as high as the seventh dorsal vertebra. On the left side, also, there is slight elevation of the cupola of the diaphragm. The diminution in capacity of the thorax, which this decrease in vertical extent tends to bring about, is amply compensated by the widening, which takes place at the same time at its base.

11 **The Breasts.**—The close physiological connection which exists between the mammary glands and the uterus is shown by the early appearance of changes in the breasts following upon conception. 1 As early as the end of the second month, a feeling of uneasiness and fulness of the breasts, with perhaps occasional shooting pains, is experienced, and at the same time they begin

to enlarge. The gradual increase in size continues till term, and sometimes is so great as to cause pressure atrophy of the skin along certain lines radiating irregularly from the nipple, and similar to those described as found upon the abdominal wall.

The increase in size of the breast is due to a slight extent to the hypertrophy of the adipose and connective tissue, but is principally the result of the increase in size of the existing acini, and of the budding out of new secreting acini. These changes cause the breast to feel harder, and to become knotty and irregular. The outlying masses of the gland can also be more distinctly felt. 2 The increased blood-supply associated with these changes is manifested by the enlargement of the superficial veins, which can be plainly seen as bluish lines on the surface.

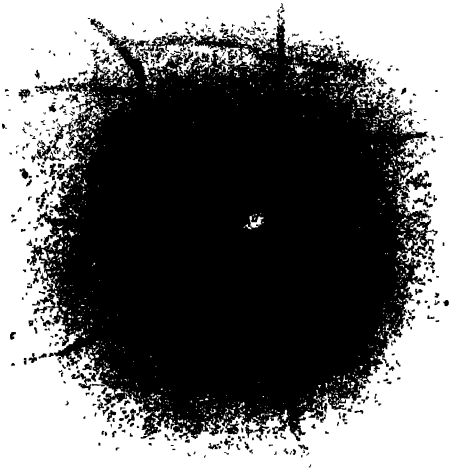

FIG. 137.—THE MAMMARY AREOLA AT THE THIRD MONTH OF PREGNANCY. (Montgomery.)

3 Most important changes from a diagnostic point of view occur in the neighbourhood of the nipple. 4 The nipple itself becomes more prominent and elevated above the surface. Its summit is somewhat flattened and directed downwards, and it tends more readily when stimulated to become turgid with blood. 6 The earliest change noticed in the areola is an enlargement of the tubercles—Montgomery's follicles*—with which its surface is studded, and a slight moistening of the skin from such of those

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* Montgomery, 'Signs and Symptoms of Pregnancy,' p. 165, 1856.

as are formed by accumulations of sebaceous glands (*v.* Fig. 137). c From the third month onwards, a gradual deepening in colour of the pigment contained within the cells of its integument can be observed, and the areola itself becomes widened. The depth of hue varies from a light brown to an almost complete black, and the extent of change is usually greater in primiparæ than in women who have borne many children, since in the latter a permanently darker tint is often retained. d The areola shares also

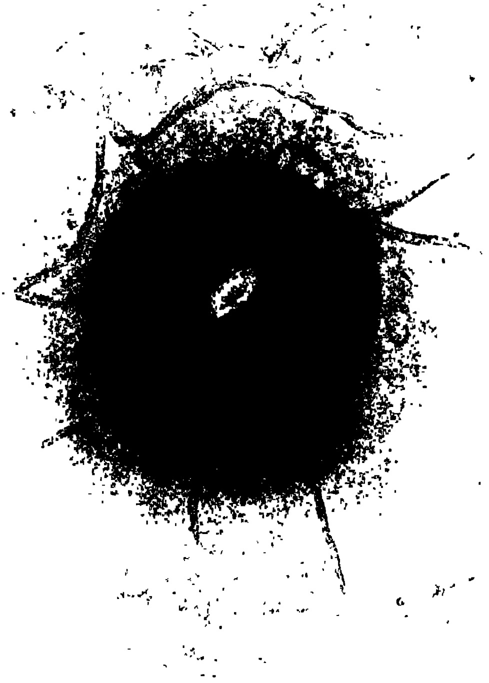

FIG. 138.—THE MAMMARY AREOLA AT THE NINTH MONTH OF PREGNANCY. (Montgomery.)

in the turgescence of the nipple. e Surrounding it for an area of an inch or more, there appears about the fifth month a ring, over which are seen numerous round spots or whitish mottled patches, 'presenting an appearance as if the colour had been discharged by a shower of drops falling upon the part.' This area has been called the secondary areola. Montgomery,* who first drew attention to it, regarded it as exclusively resulting from pregnancy, and therefore of extreme importance as a diagnostic sign.

h Preparation for the secretion of milk is made within the gland

* Montgomery, *op. cit.*

long before delivery, and from the third month onward it is usually possible to squeeze out a drop of clear mucoid fluid, which in the latter half of pregnancy contains numerous colostrum corpuscles. Occasionally, fluid may even exude spontaneously from the nipple and from the tubercles of the areola, many of which are connected with the lactiferous ducts.

The Face and Limbs.—In addition to the changes already enumerated, certain others are very commonly seen in other parts of the body. In the early months, the face often appears somewhat drawn and haggard, and dark rings under the eyes are usually present, indicative of sluggish circulation. Later on, symmetrical pigmented areas may appear of a brownish colour, and situated as a rule on the forehead, or beneath the eyes. The latter patches often coalesce over the bridge of the nose. Sometimes, no definite pigmented areas appear, but the whole face assumes a slightly deeper tint than normal. Increased pigmentation may also be found in the neighbourhood of the axillæ. The lower portion of the neck often appears unusually full due to hypertrophy of the thyroid gland, and pulsation in the gland may be very distinct. Enlargement of the thyroid also occurs, often to a marked degree, at each menstrual period in the non-pregnant state, and must be regarded as a reflex nervous phenomenon.

The veins of the lower limbs usually manifest the increased pressure, which is exerted within the abdomen upon the inferior vena cava, by becoming dilated, and œdema about the ankles is also common. In the early stages of pregnancy, the smaller superficial veins below the knee are most affected, and often appear as characteristic bunches beneath the skin. Later, the larger veins also share in the dilatation, and may become so large as to make their rupture probable.

Pelvic Joints.—The changes in the pelvic joints will be referred to when discussing the physiology of labour.

SYSTEMIC CHANGES.—The functional and systemic changes which occur during pregnancy, for the most part, tend to enable the maternal organism to supply the necessary amount of nourishment and oxygen to the growing fœtus, and to provide for the elimination of its waste products. The rapid cell proliferation and enlargement, which are taking place in the reproductive organs of the mother herself also necessitate a general increase in body metabolism.

Circulatory System.—The general enlargement of the uterine bloodvessels, and the complex arrangement of the uterine vascular system, render the quantity of blood which is present in the non-pregnant state quite inadequate to supply at a proper pressure a sufficient amount of nutritive fluid to the body generally during pregnancy. The total quantity of blood is therefore increased, but the increase consists more of the watery than of the solid constituents. The percentage amount of albumin in the liquor sanguinis and the percentage number of red blood corpuscles are diminished, but the number of white blood corpuscles, especially the polymorphonuclear variety, is increased, and the coagulation time is generally believed to be diminished, though this last statement has recently been denied. The hæmoglobin index is also said to be lowered. 2The extra work thrown upon the heart by the necessity for propelling this increased amount of fluid through the enlarged vascular system leads to slight dilatation and to hypertrophy of the left ventricle of the heart. 3The blood-pressure is higher than normal, 4and as a rule the rate of the pulse is increased.

2 **Respiratory System.**—Owing to the pressure from below upon the diaphragm, respiration becomes almost entirely of a high costal type and is somewhat embarrassed, but its rate is not increased, since the diminution in vertical extent of the thorax is compensated by an increased breadth at the base. Dyspnœa, however, readily occurs when the least exertion is undertaken. 2 As would be expected, the elimination of carbon dioxide gas is largely increased. During the last month of pregnancy, respiration again becomes easier, owing to the gradual subsidence of the uterus which occurs at that date.

3 **Urinary System.**—During pregnancy, the urine is increased in amount, probably on account of the increased blood-pressure, and becomes more watery, although the absolute amount of solids excreted is really greater. 2A copper-reducing substance, which has proved on analysis to be lactose, is often found in the second half of pregnancy, and is almost certainly absorbed into the circulation from the breasts. 3 A deposit called kyesteine is often found as a pellicle on the surface of the urine, and was at one time regarded as characteristic of pregnancy. It is, however, by no means always present in pregnancy, and, moreover, may occur in the urine of non-pregnant females and of males, being, in fact, produced by fermentation of the urine. It does not appear at once after expulsion, but on about the third day the urine becomes cloudy, and a flocculent sediment forms, which later sinks to the bottom of the vessel. If examined microscopically, it is found to be composed of crystals of triple and other phosphates, and of a large number of bacteria. 4 Throughout the whole course of pregnancy, micturition is more frequent than normal, and is especially marked while the uterus is contained within the pelvis. At the fourth month, alleviation of this unpleasant symptom may occur coincident with the ascent of the uterus.

4 **Digestive System.**—1The appetite is usually good, and a very large quantity of food is taken and assimilated in order to cope with the demand for nourishment. 2Morning sickness, which is so often present in the earlier months, must be classed as a reflex nervous phenomenon, dependent on the hypersensitiveness of the nervous system. 3The constipation that occurs is probably more the result of want of tone in the wall of the gut than of

direct pressure upon the intestines. During the whole period of pregnancy the weight progressively increases, but especially during the last three months. It has been estimated that the gain equals about one-thirteenth of the body-weight, and that the average increase is 5 lbs. 4 oz. (2,400 grammes) during the eighth month; 3 lbs. 11 oz. (1,690 grammes) during the ninth month; and 3 lbs. 6 oz. (1,540 grammes) during the tenth month (Hecker and Gassner). It is not altogether due to the development of the ovum, for the entire organism shares in the hypertrophy. Fat is deposited in many places, and most abundantly around the breasts and in the great omentum. Fat may also be found in the viscera, and sometimes gives rise to definite yellowish areas within the liver.

Nervous System.—That the nervous system is functionally altered is manifested by its heightened sensibility and irritability to nervous stimuli. The whole organism is in a state of strain, and slight causes suffice to move it either in the direction of abnormal depression and melancholia, or in the direction of excessive exhilaration. The controlling power of the will is diminished, and hysterical attacks may develop frequently in those who are already so predisposed. When the alteration is confined within physiological limits, it leads merely to occasional fits of depression, to peevishness of temper, attacks of neuralgia, and slight morning sickness. The 'longings' of pregnancy are due to the same cause. Frequently, however, the change exceeds what may be called normal, and a whole series of pathological phenomena, both physical and mental, may then make their appearance.

Osseous System.—Two changes are noticeable in the osseous system, the first of which is the result of mechanical causes, and the second the result of metabolic changes. Owing to upward and forward development of the uterus, the centre of gravity of the body is displaced slightly forward, and, to counterbalance this, the shoulders and upper part of the body move backwards. This causes the normal curvature of the lumbar region of the spinal column to be increased, and leads to an apparent approximation of the shoulders and buttocks. The obliquity of the pelvis is slightly diminished.

In 1838, Rokitansky* described what he turned puerperal osteophytes as occurring in pregnancy. They are a series of osseous-like plates occurring on the inner table of the cranial bones, between them and the dura mater, and may either remain distinct from one another or coalesce to form a continuous thin bony layer. They are largely composed of carbonate of lime, and the cause of their deposit is not clearly understood. They are not peculiar to pregnancy, being found in some wasting diseases. It is probable that in some cases they remain permanently.

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* Rokitansky, Carl, 'Manual of Pathological Anatomy' (trans. for Sydenham Society, vol. iii., p. 208).

CHAPTER II

THE DIAGNOSIS OF PREGNANCY

I The Existence of Pregnancy; Subjective Symptoms; Objective Symptoms—II The Differential Diagnosis of Pregnancy—III The Diagnosis of Nulliparity or Parity—IV The Age of Pregnancy and the Presumed Date of Labour—V The Situation of the Pregnancy—VI Single or Multiple Pregnancy—VII The Condition of the Fœtus—VIII The Presence of Complications.

It is frequently of the greatest importance to be able to make an early diagnosis of the existence of pregnancy, as upon the answer to the question, Is the patient pregnant? may depend matters of the gravest importance both to her and to her medical adviser. It is therefore incumbent on all medical men to make themselves familiar with, and capable of recognising, the various signs and symptoms which indicate pregnancy. It is also necessary that they should be familiar with the relative value of the different signs and symptoms, and not be led into the error of attributing a positive value to those which are only useful as supplementary evidence. A medical man can never too carefully remember that the evidence of pregnancy must be divided into two groups—negative evidence and positive evidence, and that the opinion he gives to the patient or her friends must be guarded in many cases unless it is dictated by certainty. The unpleasant results which may follow in some cases from a mistaken diagnosis of pregnancy for the patient and her friends—results which are certain to be reflected upon the medical adviser—must make us pay proper attention to this point. It may be possible to state with certainty that a patient is or is not pregnant, or it may not be possible to give a definite opinion. Approach every case without prejudgment, and with distrust—distrust of appearances, of the statements of the patient and her friends, and of your own powers of definite diagnosis. Then, having made a detailed examination, compare appearances, statements, and the result of your examination. We have seen a case in which a medical man, the sister of the patient, and the patient herself, all agreed in stating that the patient was pregnant, the two last adding the information that she was married and at the time of examination actually in labour. The appearance of the patient suggested a pregnancy of eight months. The examination of the patient under an anæsthetic revealed the fact that pregnancy if present was not intra-uterine, but was possibly extra-uterine. It was only after the abdomen was opened that the abdominal enlargement was determined to be due to a fibro-cystic tumour of the ovary. Then, the patient and her sister stated that the former was not married, and that it was quite impossible for her to be pregnant, a fact which was supported by clinical evidence.

In order to make a complete diagnosis in a case of supposed pregnancy, we must obtain information on the following points:—The existence of pregnancy. II The age of pregnancy and the presumed date of labour. III The situation of the pregnancy, intra- or extra-uterine. IV The number of infants. V The condition of the fœtus. VI The presence of complications.

I THE EXISTENCE OF PREGNANCY.

The various symptoms of pregnancy are divided into two groups:—Subjective symptoms, *i.e.*; the symptoms of which the patient acquaints us; objective symptoms, *i.e.*, the symptoms which we ascertain for ourselves as the result of an objective examination.

SUBJECTIVE SYMPTOMS.—The subjective symptoms of pregnancy never possess more than a negative value, inasmuch as we must entirely depend upon the patient for their accuracy. Consequently, by themselves they are, comparatively speaking, valueless. When, however, we use them as evidence supplementary to the objective symptoms, and when we find that they agree with the latter, their corroborative value is considerable. The following are the principal subjective symptoms:—

Suppression of the Menses.—As a rule, the first thing which suggests to a patient that she is pregnant is the suppression of menstruation, but it must not be forgotten that suppression may occur from many other causes. If amenorrhœa occurs in a woman in good health who has been menstruating regularly, and if the stated period of amenorrhœa corresponds with the size of the uterus and with the other results of the physical examination, amenorrhœa may be considered as of diagnostic value, otherwise its value is small. Pregnancy may be supposed to exist owing to the suppression of menstruation from, for instance, anæmia, tuberculosis, ovarian atrophy, etc. On the other hand, the presence of pregnancy may be overlooked owing to its supervention on a previous period of amenorrhœa, as during lactation; or owing to the association of a periodical discharge with pregnancy, a possibility which is avowed by some authorities, and which will be discussed later. It must not be forgotten that, if a patient desires to deceive the medical attendant, the giving of a false menstrual history is the readiest manner in which she can do so.

Quickening. — Quickening is the term applied to the sensation which the patient experiences when she detects the movements of the fœtus for the first time in any pregnancy. It is an old term which originated in the idea that its occurrence corresponded with the inception of life in the fœtus. The sensation which the patient experiences has been compared to the fluttering movements of a small bird when held in the hand. It is obvious that such a sensation can readily be simulated by other causes, more especially by the movements of flatus in the intestines, or that the fœtal movements may for some time pass entirely unnoticed, until they assume more perceptible dimensions. Consequently, the value of quickening as a diagnostic sign is very slight. It is said to occur, as a rule, about the eighteenth week. If a multiparous woman, who has had previous experience of the sensation, describes its occurrence, some importance may be attached to her statements, more especially if the date of the occurrence of quickening corresponds with the menstrual history and the physical signs. In the case of a primipara, it is a sign of no value.

3 **Morning Sickness.** — Morning sickness is the term applied to the nausea and slight vomiting which are of common occurrence during the first four months of pregnancy on wakening in the morning. As a rule, it commences at the beginning of the second month and continues to the end of the third month, but its occurrence and duration are very irregular. If it is met with in the case of an otherwise healthy woman, and if no cause other than pregnancy can be found for it, it constitutes a symptom of a slight corroborative value. Its causes will be discussed in another place.

The foregoing are the most important subjective symptoms of pregnancy, and are met with in the great proportion of, or in all, cases of pregnancy. There are, however, certain conditions which occur as tolerably regular phenomena in some women, so much so that such patients may base the knowledge that they are pregnant upon them. 4The most important of these are the occurrence of salivation,5 of various neuralgic affections,6 of temporary alterations in the temperament and the appetite. So well is the occurrence of the last of these recognised that the term 'longings,' or *pica*, has been applied to the various fancies or even cravings by which a pregnant woman may sometimes become possessed, and which are, perhaps, at complete variance with her ordinary inclinations. The older works on obstetrics are full of references to such fancies, and mention of them also occurs in general literature.* The diagnostic value of these phenomena is nil, save possibly to the patient herself.

'She can cranch
A sack of small coal, eat you lime and hair,
Soap, ashes, loam, and has a dainty spice
Of the green sickness.'
BEN JONSON: *The Magnetic Lady*, Act i., Scene 1.

OBJECTIVE SYMPTOMS.—In order to ascertain the presence of the objective symptoms of pregnancy, a careful and systematic examination of the patient must be made. We have already described the methods by which such an examination must be conducted, and the nature and cause of the changes met with, and here we shall merely enumerate the latter and discuss their diagnostic value.

The Face. — The only alteration of importance which is noticeable on the face is the increase in pigmentary deposit. This occurs especially at the sides of the nose, under the eyes, and in the region of the upper lip. Its diagnostic value is slight.

The Breasts.—The relation between the breasts and the generative organs is so close that naturally early indications of pregnancy are to be found in the former. The various changes which occur have been already described; in their order of relative importance they are as follows:—

(1) *Enlargement and Increased Firmness of the Breast.*—A slight degree of fulness of the breasts may be appreciated by the patient herself within a few weeks after conception, but it is not until the completion of the second month that any enlargement is noticeable to the physician. From that time on, the breasts become progressively larger, firmer, and more knotty. Both these alterations are very constant in pregnancy, but they may also result from other causes, and may be found in association with myomata of the uterus and ovarian tumours. Accompanying the enlargement of the breast itself is an enlargement of the superficial veins, causing the appearance of a delicate marbling of the skin. This change is, perhaps, more confined to pregnancy than is the enlargement of the breast tissue, inasmuch as it is evidence of an acuter process of hypertrophy than would occur in the case of an ovarian or uterine tumour.

(2) *The Presence of Fluid.*—The presence of a little fluid in the breast can usually be determined from the third month onwards, if the breast is gently squeezed in the direction of the nipple. Such fluid is usually clear, and, though its presence is almost invariably associated with pregnancy, it affords no positive evidence of its existence, as it is very frequently met with in cases of uterine enlargement from other causes, and of ovarian tumours. It can also be frequently found in the breast of a multipara, even when not pregnant, in which case it is probably the remains of a previous lactation. Later in pregnancy, an opaque fluid can usually be expressed from the breast, containing colostrum corpuscles. It is said that the presence of these corpuscles is an almost, if not absolutely, certain sign of pregnancy (Galabin).

(3) *Alterations in the Nipples and the Primary Areola.*—The most important of these alterations consist in a turgescence of the nipple and of the skin round it, in a deepening of the colour of the primary areola, and in the presence of Montgomery's follicles on the areola. The turgescence of the nipple is said to be

found from the end of the second month onwards, while the other changes take place during the following two or three months. Turgescence is very characteristic of pregnancy, but may also occur in connection with the other causes of uterine irritation.

(4) *The Secondary Areola.*—The presence of this can be determined from the fifth month onwards. It was said by Montgomery, who described it, to 'exclusively result from pregnancy.' It is, however, difficult to say definitely that it may not and does not result from other causes, and consequently it is not advisable to include it among the certain signs of pregnancy. Moreover, at the time at which the secondary areola appears, it is usually possible to obtain more positive proof.

The diagnostic value of the foregoing signs depends largely upon the fact that their existence can be determined without arousing the suspicions of the patients as to the reason for our examination. This is particularly the case in girls suffering from amenorrhœa, the cause of which is uncertain. In such cases, under the pretext of examining the heart, we can frequently detect mammary signs, which, though not sufficient to base a definite diagnosis upon, are yet still sufficiently suggestive to enable us to form a fairly reliable private opinion of the nature of the case.

3 **The Abdomen.** — As the abdominal signs of pregnancy possess the greatest diagnostic value, it will be well to enumerate them under different headings, according to the method of examination by which they are elicited.

Inspection.—The following changes which take place in the abdomen during pregnancy can be determined by inspection :—

(1) Change of Shape.—During the first two months, the abdomen between the symphysis and the umbilicus is flatter than usual, probably owing to the sinking of the uterus into the pelvic cavity and the consequent additional room afforded for the viscera. It is quite a contrary change to what would be expected, but has been regarded as a sign of pregnancy for a very long time, as various old proverbs show.* From the middle of the fourth month onwards, the abdomen enlarges symmetrically and progressively up to the end of the ninth month. Then, during the tenth month, the fundus falls to the level it occupied at the end of the eighth month.

(2) Increase of Pigmentary Deposit.—There is very commonly a well-marked brown line running from the umbilicus to the symphysis, and increased pigmentation in the neighbourhood of the groin.

(3) Occurrence of striæ, or lineæ gravidarum.

(4) The Movements of the Fœtus.—These may be seen during

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* 'En ventre plat Un enfant il y a.'	'In a belly that's flat There's a child—be sure of that.'

the last three months of pregnancy, or even earlier in the case of a strong fœtus and a thin abdominal wall.

The results of inspection are, with the exception of the last, of no great value from a diagnostic point of view. 5 + [illegible] umbil[illegible]

Percussion.—By means of percussion of the abdomen the existence of a tumour, dull on percussion and medianly situated, can be determined, and its contour mapped out.

Palpation.—The following signs can be detected by means of abdominal palpation:—

(1) The Presence of a Tumour in the Abdomen.—After the fourth month a tumour can be felt rising out of the pelvis and extending into the abdomen to a degree proportionate to the period of pregnancy. It is medianly situated, smooth, and uniform in outline, with fluid contents, in which, after the fourth month, the fœtus can be felt. (By abdominal [illegible]

(2) The Fœtal Parts and Movements.—The fœtal parts can be felt by external ballottement, in a favourable case, as soon as the uterus has risen sufficiently far above the pelvic brim to enable this manipulation to be performed. Up to the end of the fifth month, the entire fœtus can be moved in this way inside the uterus; but, after the fifth month, the fœtus has reached too large a size in comparison with the size of the uterine cavity to allow this, and consequently only a portion of it—a limb or the head—can be ballotted. As the sensation of ballottement can only be conveyed by a solid body floating in fluid, there are very few conditions save pregnancy which can furnish it. External ballottement can in all probability only be simulated by a subperitoneal pedunculated myoma, or by cancerous masses, floating in ascitic fluid, or by the extremely improbable association of an intra-uterine polypus and hæmatometra or pyometra. In the former cases, the fact that the outline of the uterus cannot be felt will usually enable us to exclude pregnancy; in the latter case, the attendant symptoms and the results of a further examination will be sufficient to make the condition present obvious. During the last four months of pregnancy, the fœtal parts can, in addition, be palpated and recognised. The active movements of the fœtus can be readily felt by laying the hand on the abdomen over a limb and keeping it there for a moment. If the fœtus is pushed slightly with the other hand, it will usually respond with a movement, or if the patient takes a deep breath the same result is said to follow (Jacquemin).

(3) The Contractions of the Uterus.—The occurrence of painless and intermittent contractions of the uterus which are perceptible from the third month of pregnancy onwards was first determined by Braxton Hicks,* by whom its value as a symptom of pregnancy was also demonstrated. It is consequently known as Braxton Hicks' sign. In the later months of pregnancy it is

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* 'Selected Essays and Monographs from English Sources,' New Sydenham Society, vol. clxxiii., p. 25.

easy to determine its presence by laying one hand flat on the abdomen, but in the earlier months it is more difficult. Braxton Hicks' directions for obtaining it are as follows: 'If, then, the uterus be examined without friction or any pressure beyond that necessary for full contact of the hand continuously over a period of from five to twenty minutes, it will be noticed to become firm if relaxed at first, and more or less flaccid if it be firm at first. It is seldom that so long an interval occurs as that of twenty minutes; most frequently it occurs every five or ten minutes, sometimes even twice in five minutes.' Braxton Hicks admits that this sign may also occur in some myomatous tumours, but thinks that in such cases it is not difficult to make a differential diagnosis.

The information afforded by abdominal palpation is most important, particularly in the later months of pregnancy. The recognition of the fœtal parts and the detection of the fœtal movements are certain signs of pregnancy. External ballottement is an almost, but not absolutely, certain sign, while Braxton Hicks's sign is of great value as a corroborative sign.

Auscultation.—The various signs which can be detected by auscultation are as follows:—

(1) The Fœtal Heart.—This can be detected from the sixteenth to the eighteenth week onward. It can only be confused with the maternal heart or the pulsations of the listener's heart. In either case, the error can readily be avoided by comparing their respective rates with that of the presumed fœtal heart.

(2) The Funic or Umbilical Souffle.—This is only heard under certain conditions to which reference has been already made. It can be confused with the uterine souffle, or a cardiac bruit transmitted from the maternal heart.

(3) The Uterine Souffle.—This can be heard in practically every case, and may be detected as early as the fifteenth or sixteenth week—a time at which it is rarely, if ever, possible to detect the fœtal heart. It may, however, be also heard in uterine enlargements from other causes than pregnancy.

(4) The Movements of the Fœtus.—It is sometimes possible to detect the fœtal movements by auscultation. As, however, it is difficult to do so, as they can be confused with intestinal sounds, and as at the time when they can be heard it is possible to ascertain the existence of a fœtus by other means, the diagnostic value of this procedure is small.

The auscultatory signs of pregnancy possess a high diagnostic value. The fœtal heart and the funic souffle are the earliest certain signs of pregnancy; the uterine souffle is a probable sign, and is of value when found in conjunction with other signs.

4 **The Vulva and Vagina.**—The information afforded by examination of the vagina and vulva is of extreme importance in the diagnosis of pregnancy. The various signs which are thus determined are as follows:—

(1) *Alteration in Colour of the Vulvar and Vaginal Mucous Membrane.*—Attention was first called to the importance of this change as a sign of pregnancy by Jacquemin, of Paris, who said that in cases of pregnancy the vulvar and vaginal mucous membrane became of a violet colour, like the lees of port wine. The altered colour is, however, perhaps better described by Montgomery as being of a livid or dusky hue.* It can, as a rule, be detected during the second month, and increases in intensity during the next three months, at the end of which it has, perhaps, attained its maximum. It persists throughout pregnancy. In the vulva, it is most distinct on the inside of the labia minora, and round the urethra. In the vagina, it increases in intensity from below upwards, and is most marked in the fornices. Its intensity varies considerably in different subjects. As it is purely mechanical in origin, and is dependent on venous stasis due to the pressure of the enlarged uterus on veins already engorged with blood, it can occur in conditions other than pregnancy. Thus, it may be met with during menstruation and in certain cases of uterine myomata. It is, however, undoubtedly better marked in pregnancy than in either of these conditions, and consequently possesses a definite diagnostic value.

(2) *Alteration in the Size, Shape, and Consistency of the Uterus.*—The first point which will attract the attention of the obstetrician on making a bi-manual examination of the uterus is the enlargement in the size of that organ. The size of the uterus at the different months has been already mentioned, and need not be again referred to. It is only necessary to call attention to the fact that in the early months one may be misled by the soft and flaccid condition of the uterus, and may overlook this enlargement. If a careful bi-manual examination is made this will not be the case.

In shape, the uterus becomes more globular during the first three months, in consequence of an increase in its antero-posterior diameters.

The alteration, which takes place in the consistency of the uterus, is one of the most important early signs of pregnancy. It must be considered from three points of view :—a Its effect on the uterus as a whole ; b its effect upon the cervix ; c its effect upon the lower uterine segment.

The entire uterus becomes softer in consistency than it is in an unimpregnated condition, and more elastic—changes due to the increased blood-supply. This softening, however, particularly affects two portions of the uterus—the cervix and the junction of the body and the cervix. b The softening of the cervix proceeds progressively from below upwards, and can be noticed from the second month onwards. At first, it affects the cervical mucous membrane alone, but, gradually, the deeper tissues are involved, and, finally, the entire cervix is so softened that to the examining

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* 'Signs and Symptoms of Pregnancy,' 2nd edition, p. 243.

finger it conveys as little sensation as if it was non-existent. The softening of the lower uterine segment just above the insertion of the utero-sacral ligaments was first described as a sign of pregnancy by Hegar.* We have already described how it can be detected. It is very characteristic, it can be obtained from the second month onwards, and so it is one of the most reliable, or perhaps the most reliable, of the early signs of pregnancy.

(3) *Internal Ballottement.*—Internal ballottement of the fœtus can be obtained from the time the fœtus is sufficiently large to be perceptible until it becomes too large to be freely movable inside the uterus—that is, from the commencement of the fourth to the end of the fifth month. After the latter month, the fœtus can be displaced by the upward pressure of the fingers, but it will not fall back again on to the finger. Internal ballottement can undoubtedly be best obtained when the patient is in the erect position, but, as it is not usually possible to make a vaginal examination in this manner, ballottement must be obtained while she is in the dorsal position. If a few possible sources of error are excluded, internal ballottement is an almost certain sign of pregnancy. It can, however, also be obtained in the case of a pedunculated myoma or malignant masses floating in ascitic fluid, or inside a uterus in which there is an accumulation of blood or other fluid, or in the case of a large calculus lying in a distended bladder.

(4) *Hypertrophy of the Ureters.*—The increase which occurs during pregnancy in the size of the ureters can be detected by anyone who has made himself familiar with the size of the non-hypertrophied ureter as felt from the vagina. To palpate the ureter, pass the index finger into the vagina until the anterior fornix is reached, and lay the tip on the upper margin of the symphysis with the palmar surface forwards. Then, draw the finger gently downwards and outwards along the posterior surface of the pubes, and the ureter will be felt as a cord which runs at right angles to the direction in which the finger is moving, and which slips away from beneath the latter.

(5) *Increased Pulsation in the Lateral Fornices.*—This will be found in any condition in which the blood-supply to the uterus is increased, and, consequently, does not possess any very great diagnostic importance.

The information afforded by vaginal examination is of great diagnostic value, particularly in the early months of pregnancy, when the information which can be subsequently obtained by examination of the abdomen is not available. It is true that no certain sign of pregnancy can be elicited in this manner; but two probable signs can be obtained, which, if found in conjunction, almost certainly point to the existence of pregnancy. These signs are,—Hegar's sign and internal ballottement.

It will perhaps be found of service if we tabulate the foregoing signs of pregnancy according to their importance, and if, at the same time, we mention the period at which they can usually be obtained. We shall group them in three classes:—the certain signs, which can only occur as a result of pregnancy; the probable signs, which are most frequently associated with pregnancy, but which may be more rarely met with under other circumstances; and the possible signs, which are present during pregnancy, but which are frequently also met with under other circumstances.

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* *Prager Med. Wochenschr.*, 1884, No. 26.

Nature of Sign.	Time at which Detectable.	Value.
The fœtal heart - -	Eighteenth week onwards - - -	Certain sign.
The fœtal parts - -	Last four months - -	,,
Movements of fœtus, when felt, heard, or seen by medical man -	Last three months -	,,
Funic souffle - - -	Occasionally heard during last two or three months - -	,,
Breast changes - -	Second month onwards	Probable sign.
Vaginal discoloration -	,, ,,	,,
Hegar's sign - - -	,, ,,	,,
Hypertrophy of ureters -	,, ,,	,,
Enlargement of uterus -	,, ,,	,,
Internal ballottement -	Fourth and fifth months	,,
Uterine souffle - -	Fifteenth week onwards	,,
Intermittent contractions	Fourth month onwards	,,
External ballottement -	Fifth month onwards -	,,
Subjective symptoms -	Second month onwards	Possible sign.
Pigmentation of face and abdomen - - -	Fourth month onwards	,,
Enlargement of abdomen	,, ,,	,,

THE DIFFERENTIAL DIAGNOSIS OF PREGNANCY.

From the foregoing account of the diagnostic signs of pregnancy, it will be readily understood that even in straightforward cases of uncomplicated pregnancy a certain, or even a probable, diagnosis is impossible during the first month. From the second to the middle of the fourth month, certainty is equally impossible, but it is usually easy to make a probable diagnosis. While, from the end of the fifth month onwards, a certain diagnosis can be readily made. If, however, the nature of the case is obscured by the co-existence of pathological conditions, then the difficulty of making a diagnosis may be great, even during the tenth month. Here, we propose to discuss the differential diagnosis of pregnancy, and the best method in which to do so will be to enumerate the various pathological conditions which may tend to simulate a non-existent pregnancy or to obscure an existing one, and to compare their symptoms and signs with those of pregnancy.

The following conditions may be confounded with pregnancy:—

1. **Amenorrhœa from Causes other than Pregnancy.** — The presence of regular and normal menstruation is a definite sign that the patient is not pregnant; but the mere fact that menstruation is absent, unless supported by other evidences, is of slight diagnostic value. Amenorrhœa very commonly occurs in young girls from sixteen to twenty owing to ill-health, and in cases in which it is accompanied by an increased deposit of fat in the abdominal walls the condition is at first sight very suggestive of pregnancy. It is in these cases that the early information afforded by the examination of the breasts, and the possibility of obtaining this information without exciting the suspicions of the patient, are so important.

2. **Enlargement of the Uterus.** — Enlargement of the uterus from causes other than pregnancy, and of such a kind that it can be confused with pregnancy, is by no means an uncommon condition. It may result from the following conditions:—

(1) *Chronic Metritis and Endometritis.*—In enlargement from this cause, the uterus is more firm in consistency than is the case in pregnancy, and the globular shape of the body and the softening of the lower uterine segment are absent. As a rule, the cervix is also more firm than in pregnancy; but in some cases, where endometritis is associated with erosion or ectropion of the cervical mucous membrane, or where there is considerable congestion of the uterus, softening of the cervix may also occur. In metritis associated with sub-involution, the diagnosis may be particularly difficult; but, as a rule, the history of the case will enable the cause of the enlargement to be determined.

(2) *Tumours of the Body.*—Uterine enlargement caused by small fibro-myomatous tumours, or by malignant disease of the body, may sometimes be of such a kind as to resemble pregnancy. In the former case, especially when the tumour is interstitial or submucous, there may be considerable difficulty in diagnosis, as the uterine enlargement of the uterus is then often uniform, and all the signs of pregnancy which are dependent on uterine congestion may be well marked. The history, especially the menstrual history is, however, usually at variance with the suggestion of pregnancy; while in a case of doubt time will clear up the nature of the case.

Uterine enlargement caused by large myomata is usually not very difficult to distinguish from pregnancy. The enlargement is, as a rule, irregular, the consistency of the uterus is firmer, and the fœtal parts cannot be felt nor the fœtal heart be heard. On the other hand, in some cases the enlargement may be uniform, or the irregularities may be of such a shape as to counterfeit fœtal parts. Real difficulty in diagnosis is, however, rarely met with, save in complicated cases in which a pregnancy and a myoma, a myoma and an ovarian tumour, or a myoma and ascites co-exist. In such cases, the diagnosis may be most difficult, but can usually be made by comparing the results of a careful examination under an anæsthetic with the history of the case.

(3) *Hæmatometra.*—The retention of the menstrual fluid in the uterus, as a result of atresia of the upper part of the vagina or the cervix, may simulate pregnancy, as it will cause a cystic enlargement of the uterus associated with amenorrhœa. The history of the case will, however, usually enable a diagnosis to be made, as the duration of amenorrhœa in association with the size of the uterus, the spasmodic increase in size of the latter—occurring during what ought to be a menstrual period, and the pain with which this increase is attended, are opposed to the probability of pregnancy. If the history is not sufficient, a vaginal examination will reveal the presence of an atresia.

Ovarian Tumours.—Small ovarian tumours may be mistaken for an extra-uterine pregnancy. The diagnosis between them will be subsequently referred to. Larger tumours may be mistaken for a pregnant uterus, but, usually, save in the presence of complications, the diagnosis is easy. The growth of an ovarian tumour is, as a rule, slower than that of a pregnant uterus, menstruation is usually not suppressed, and in most cases it is possible to determine the presence of the uterus beside the tumour. If, however, the case is complicated by ascites, or by a co-existent pregnancy, it may be most difficult to make an exact diagnosis. In the former case, it will be well to tap the abdomen and draw off the ascitic fluid if a diagnosis cannot be otherwise made.

Other Causes of Abdominal Enlargement.—Other causes of abdominal enlargement which may give rise to a suspicion of pregnancy are as follows:—

(1) *An Overfull Bladder.*—A bladder, which has become considerably overdistended, may sometimes be found as an ovoid fluctuating tumour reaching to the umbilicus, and perhaps contracting intermittently. It sometimes occurs during pregnancy, especially in association with the condition known as incarceration of the retro-deviated pregnant uterus. It may also occur independently of pregnancy, as a result of compression of the neck of the bladder. A diagnosis is not difficult, as it will be impossible to obtain internal or external ballottement or to hear the fœtal heart, while the passage of a catheter causes the enlargement to disappear. These cases are, however, calculated to cause errors in diagnosis if the possibility of the presence of a distended bladder is overlooked.

(2) *Accumulation of Fat in the Abdominal Wall or Omentum.*—This condition will only give rise to confusion in diagnosis in cases in which it is associated with amenorrhœa, as has been already mentioned, and perhaps in patients near or past the climacteric, in whom menstruation has ceased.

(3) *Phantom Pregnancy, or Pseudo-Cyesis.*—It has sometimes happened that patients have, for purposes of fraud, deliberately endeavoured to feign a condition of pregnancy, or that they have actually, and with perfect *bonâ fides*, persuaded themselves that they are pregnant, and that they have succeeded in convincing their medical advisers that such is the case. In some of these cases, the patients succeed in creating not alone the appearance, but even the sensation on palpation, of the presence of a tumour. In cases of fraud, this 'tumour' may be created by allowing the bladder to become overdistended, while in the other class of cases the 'tumour' is probably due to a deposit of fat in the abdominal walls or omentum, or to flatulence associated with contraction of the abdominal muscles. If the patient is carefully examined, there is no difficulty in making a diagnosis. On percussion the abdomen is resonant, and, if an anæsthetic is administered, the rigidity of the muscles and the supposed tumour disappear.

(4) *Ascites.*—A collection of fluid in the peritoneal cavity will not give rise to any difficulty of diagnosis unless it is encysted beneath the abdominal wall in the position which a pregnant uterus would occupy, or is complicated by pregnancy or by the presence of a tumour of the uterus or ovary. In such cases, the diagnosis may be extremely difficult, but it can usually be made from the history of the case and the results of a careful examination under an anæsthetic. In the case of ascites complicating an abdominal enlargement, it may be necessary to tap the abdomen and draw off the fluid, in order to ascertain the exact nature of the case.

III The Diagnosis of Nulliparity or Parity.

It is sometimes a matter of medico-legal importance to be able to determine whether a patient has been previously pregnant or not. It may be stated that, as a general rule, it is impossible to tell whether a patient has or has not had a previous abortion; but, if delivery has occurred during the last four months of pregnancy, it is usually possible to determine the fact. In making a diagnosis, we rely upon the condition of the following parts:—

(1) **The Breasts.**—In a pregnant nullipara, the breasts are firm and smooth, and the striæ present are recent, and are consequently of a red or purplish colour. In a pregnant parous woman (*i.e.*, a woman who has borne children), the breasts are comparatively flaccid and pendulous, the primary areola is more marked, and the nipple is longer than in the nulliparous woman. There are both recent and old striæ, the latter of a pearly white colour, resembling an old cicatrix. The intensity of these differences will, however, largely depend upon whether the patient has suckled her infant or not.

(2) **The Abdominal Wall.**—In a nullipara, the abdominal wall

is, like the breast, smooth and tense, there is no marked separation of the recti, and only recent striæ are present. In a parous woman, the wall is flaccid and more or less wrinkled, the recti are as a rule somewhat separated, and there are both old and recent striæ.

(3) **The Vulva.**—In virgins, the hymen is intact, unless there has been previous surgical interference of such a nature as to cause its rupture. In nulliparous women, who are not virgins, the hymen is almost invariably torn, but its remains can readily be found, and if the flaps are arranged in their proper position the membrane may be shown to be complete. In a parous woman, on the other hand, the hymen is not only torn, but has almost entirely disappeared, and is only represented by small tags, known as carunculæ myrtiformes. The condition of the hymen is not, however, an irrefragable proof of either virginity or parity. It is well recognised that cases may occur in which the patient becomes pregnant without rupture of the hymen, and cases have even been recorded of delivery without rupture; while, on the

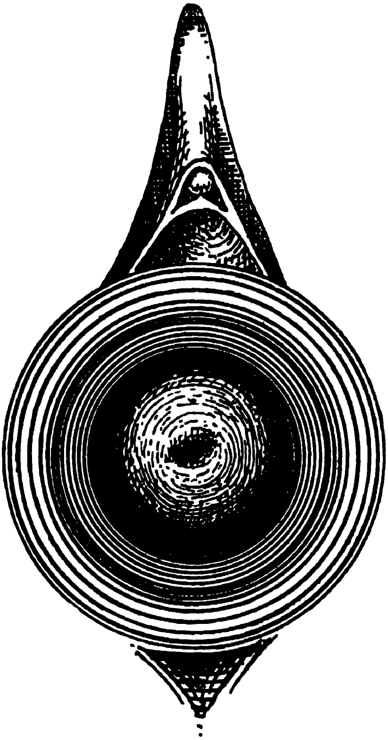

FIG. 139.—DIAGRAM OF OS UTERI IN A NULLIPARA AS SEEN THROUGH A SPECULUM.

other hand, as has been mentioned, rupture may be due to surgical interference. Macnaughton-Jones[*] describes a condition which he terms 'folding hymen,' in which the hymen, instead of lacerating, folds back against the vaginal wall when pressed upon, and when the pressure is removed returns into its former position. Besides the condition of the hymen, there are other vulvar changes. In nulliparæ, the fourchette is intact and the perinæum unlacerated; in parous women, the fourchette is almost invariably torn, and the perinæum is frequently slightly lacerated; the frænulum is also often torn, and minute linear cicatrices may be found round the orifice of the urethra and the head of the clitoris.

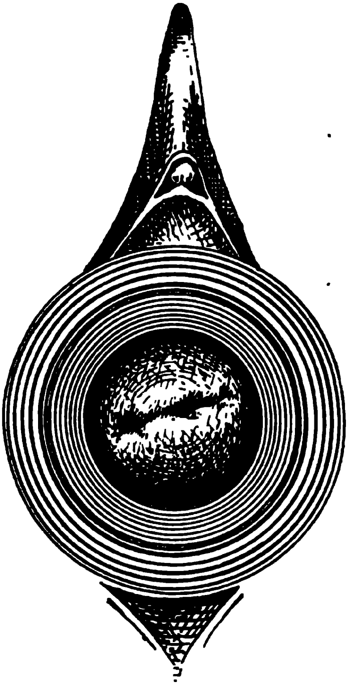

FIG. 140.—DIAGRAM OF OS UTERI IN A PAROUS WOMAN AS SEEN THROUGH A SPECULUM.

(4) **The Vagina.**—In nulliparæ, the vaginal mucous membrane is rugose; in parous women, the rugæ have disappeared, the whole canal, and particularly the orifice, is larger, and cicatrices may be found on the posterior wall.

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[*] 'Diseases of Women,' eighth edition, p. 9.

(5) **The Uterus.**—The condition of the cervix is, perhaps, the most important sign of parity. In nulliparous women, the orifice of the os externum is circular and the mucous membrane smooth and intact. In parous women, the orifice is a transverse slit, with notched edges or a unilateral, a bi-lateral, or a tri-radiate tear, due to the occurrence of lacerations. The body of the uterus is, perhaps, more relaxed if previous pregnancies have occurred. It is well to point out that cervical changes may be almost or entirely absent if, in the previous pregnancy, the fœtus was very small, and that, on the other hand, a linear os and an apparent bi-lateral laceration may be the result of operative division of the cervix.

THE AGE OF PREGNANCY AND THE PRESUMED DATE OF LABOUR.

As soon as the existence of pregnancy has been ascertained, the next point to be determined is the age of pregnancy, with a view to predicting the date of delivery. This is always a difficult matter to decide with certainty, and one on which the obstetrician should never be too positive. We have already seen that it is not possible to be certain when pregnancy commences, and accordingly it is correspondingly difficult to determine when it it will end. All that the obstetrician can do is to fix on an approximate date, and to consider it as the middle week of three during which delivery may take place.

The probable date of delivery may be determined in four different ways:—From the date of last menstruation; from the date of quickening; from the height of the uterus; and from the length of the fœtal ovoid.

(1) **From the Date of Last Menstruation.**—As we have seen, pregnancy may be considered to last for ten lunar months, or 280 days, counting from the first day of the last menstruation, and consequently, if we count forward this number of days, we shall arrive approximately at the date of delivery. There are many ways by which this can be done, but perhaps the most simple is that proposed by Matthews Duncan. He counted forward nine months from the last day of the last menstruation, and to the date thus obtained added three days. Thus, if the menstruation which began on July 1st ended on July 5th, then nine months and three days added on brings the date to April 8th. If we wish to be more exact, and make due allowance for the difference in the lengths of the different months, we can adopt the following table drawn up by Galabin:—

Jan. 1 to Oct. 1	is 273 (274)	days, therefore	add 9	months and	5 (4)	days.
Feb. 1 to Nov. 1	is 273 (274)	,,	,,	,,	5 (4)	,,
Mar. 1 to Dec. 1	is 275	,,	,,	,,	3	,,
April 1 to Jan. 1	is 275	,,	,,	,,	3	,,
May 1 to Feb. 1	is 276	,,	,,	,,	2	,,
June 1 to Mar. 1	is 273 (274)	,,	,,	,,	5 (4)	,,
July 1 to April 1	is 274 (275)	,,	,,	,,	4 (3)	,,

Aug. 1 to May 1	is 273 (274)	days, therefore	add 9 months	and	5 (4)	days.
Sept. 1 to June 1	is 273 (274)	,,	,,	,,	5 (4)	,,
Oct. 1 to July 1	is 273 (274)	,,	,,	,,	5 (4)	,,
Nov. 1 to Aug. 1	is 273 (274)	,,	,,	,,	5 (4)	,,
Dec. 1 to Sept. 1	is 274 (275)	,,	,,	,,	4 (3)	,,

This table shows the number of days between a fixed date in any month and the same date nine calendar months subsequently, and the consequent number of days which it is necessary to add on in order to reach the 278th day—the figures in brackets are to be used in leap year. Thus, if July 5th be the last day of the last menstruation, in a non-leap year, the subsequent April 5th will be 274 days on, and, if four days are added to this, a date 278 days from the date of last menstruation is obtained—*i.e.*, April 9th. The difference between the two methods is accounted for by the fact that the former does not allow for the loss of a day in February.

(2) **From the Date of Quickening.**—This is an unreliable method of determining the date of delivery if used alone. If, however, it is used as an adjunct to the method just given, it is of assistance. Quickening, as we know, as a rule occurs during the eighteenth week. Consequently, if we add on twenty-two weeks to this date, we shall obtain the approximate week of delivery. It sometimes happens that a patient may be unable to remember the month in which her last menstruation occurred, or that she is uncertain as to whether what she considered a menstruation was one or not, and consequently an error of a month may be made by the previous method. If the date of quickening can be reliably ascertained, it will, at all events, show from what month we ought to count.

(3) **The Height of the Uterus.**—We have already mentioned the usual height of the uterus above the symphysis at the different months of pregnancy as ascertained by measurement. For clinical purposes the following table is, however, sufficiently accurate:—

At the end of	2nd	month	the uterus is	the size of a large orange.
,,	3rd	,,	,,	,, fœtal head at term.
,,	4th	,,	the fundus is	halfway between the symphysis and the umbilicus.
,,	5th	,,	,,	two fingers' breadth below the umbilicus.
,,	6th	,,	,,	at the umbilicus.
,,	7th	,,	,,	three fingers' breadth above the umbilicus.
,,	8th	,,	,,	midway between the umbilicus and the ensiform cartilage.
,,	9th	,,	,,	up to the ensiform cartilage.
,,	10th	,,	,,	same as at eighth month.

As the uterus reaches approximately the same height at the end of the eighth and of the tenth month, it is necessary to be able to distinguish between the two. At the eighth month, the abdomen is less prominent and is perceptibly smaller than it subsequently is at the tenth. The patient also, if questioned, will tell us during the eighth month that the symptoms caused by the pressure of the uterus against the diaphragm are increasing from day to day, while during the tenth month they are diminishing.

(4) **The Length of the Fœtal Ovoid.**—The length of the fœtal ovoid can be directly measured during the second half of pregnancy by placing one blade of a calipers on the pelvic pole of the fœtus *per vaginam*, and the other blade on the abdominal wall in close contact with the fundal pole. The following table gives

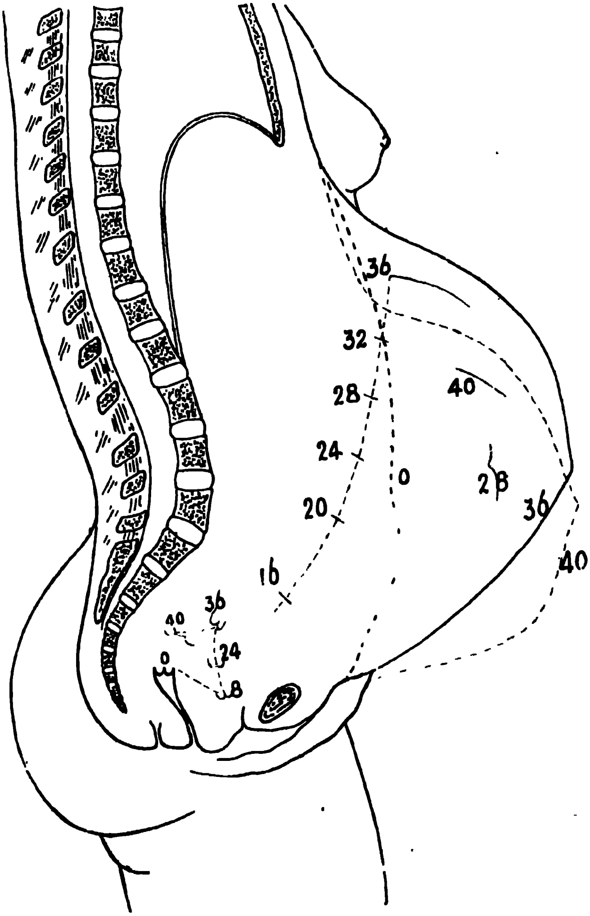

Fig. 141.—The Height of the Uterus at the Different Weeks of Pregnancy. (Dickinson.)

the average length of the fœtal ovoid as ascertained in this manner:—

		7½		8⅓		9·5		9⁶⁄₀
Week of pregnancy - -	26,	28,	30,	32,	34,	36,	38,	40.
Length of fœtus in inches - -	7·2,	7·6,	7·9,	8·3,	8·8,	9·2,	9·5,	9·7.

This method can be adopted in cases in which it is of considerable importance to gain a correct idea of the age of pregnancy or of the size of the fœtal ovoid. In ordinary practice, however, it entails more vaginal manipulation than is either necessary or advisable.

In cases in which the ovum has been expelled, its age can be ascertained by direct measurement of the length of the embryo or fœtus. The following rule furnishes an easy way of remembering the fœtal length at the end of the different months:—To obtain the length of the fœtus in centimetres for each month up to the fifth, square the number of the month; after the fifth, multiply the number of the month by five. Thus, at the end of the third month, the length of the fœtus is 3 by 3 centimetres—*i.e.*, 9 centimetres; at the end of the seventh it is 7 by 5 centimetres—*i.e.*, 35 centimetres.

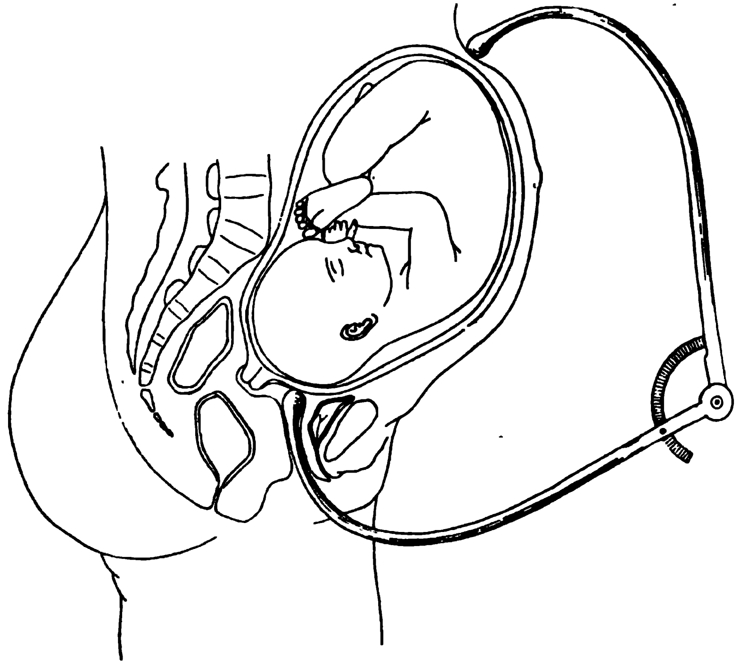

FIG. 142.—DIAGRAM SHOWING METHOD OF MEASURING THE LENGTH OF THE FŒTUS *in utero* WITH CALIPERS.

V The Situation of the Pregnancy.

It is most important to determine whether we are dealing with an intra- or extra-uterine pregnancy. It is true that in cases which are apparently normal it is not customary to submit the patient to the necessary examination for determining this point, but, if any symptoms occur which suggest the possibility of an extra-uterine pregnancy, such an examination should always be made. We shall not here refer to the diagnosis of an extra-uterine pregnancy, as it will be more suitably dealt with in the chapter on that condition.

VI Single or Multiple Pregnancy.

It is always well when examining a pregnant patient to determine, if possible, whether we are dealing with a case of single or multiple pregnancy. The diagnosis can be best made by auscultation and abdominal palpation. There is only one certain method of diagnosing the existence of twins prior to delivery:—if two observers, listening at the same time, hear and count two fœtal hearts and find that their results do not correspond. If, however, monsters are excluded, the palpation of two fœtal heads, or breeches, or of more than two large parts—*i.e.*, either a head or a breech, or of more than four limbs, is conclusive evidence that there is more than one fœtus. It is rarely possible to diagnose the existence of triplets, though it doubtless has been done. The only method of so doing would be the recognition of three distinct fœtal hearts by careful auscultation. Abdominal palpation in such cases will not afford much assistance on account of the small size of each fœtus.

VII The Condition of the Fœtus.

In the early months of pregnancy, we can infer the continued life of the fœtus so long as there is no interruption to the course of pregnancy, and so long as the patient's symptoms continue to be those of normal pregnancy. In almost all cases, if the fœtus dies, the ovum is expelled either in part or altogether. If it is retained, as may happen, a condition of missed abortion or labour occurs according to the period of pregnancy. In either case, the symptoms of the patient will sooner or later call attention to her condition. 1 There is usually a brown discharge from the uterus, or, perhaps, slight recurrent hæmorrhages. If the membranes have ruptured, the discharge may be putrid. 2 The growth of the uterus ceases, and, if the condition persists, the uterus diminishes in size consequent upon the absorption of the liquor amnii. 3 The breasts become flaccid and the secondary areola disappears. If the patient is in the last four months of pregnancy and no fœtal heart can be heard, even on the most careful examination, the fœtus is probably dead. If on making a vaginal examination the cranial bones are found to be loose and movable beneath the scalp, the fœtus is certainly dead. The subjective symptoms of the patient are also of importance. Her general health suffers in consequence of the absorption of ptomaines from the dead fœtus, and in proportion to the size of the latter and the time it has been dead. She complains of loss of appetite, debility, and of various unpleasant sensations, such as chills, a disagreeable taste in the mouth, unpleasant dreams, and such like. The movements of the fœtus are no longer felt, and, in some cases, the patient may give a definite history of having felt them as usual up to a certain date, when they became more violent than they had formerly been, and then ceased. In appearance, she is sallow, or even slightly jaundiced. If decomposition of the ovum has occurred, the usual symptoms of sapræmic poisoning follow.

If, on the other hand, the fœtus lives and develops in the normal manner it is usually always possible to detect the fœtal heart, if the sixth month is passed, and to appreciate fœtal movements if we examine for a sufficient length of time.

III THE PRESENCE OF COMPLICATIONS.

The final step in the diagnosis of pregnancy consists in ascertaining the presence or absence of complications. The different methods by which we obtain this information have been already described (*vide* Part II., Chap. III.), and need not be repeated. Here, it is only necessary to insist upon the early recognition of complications, as by so doing their prognosis is, in many instances, greatly improved. It may appear to the student as if the necessary examination for the elimination of all possible complications would be so long and severe that no patient would consent to it. This is not so. With experience, it soon becomes possible to ascertain from the appearance of the patient and the answers to a few questions, whether it is necessary or not to inquire minutely into any special point. Thus, it is manifestly unnecessary to examine a patient to determine whether the pelvis is contracted, if she has already been normally delivered of a full-term living child, or to make a vaginal examination to determine the existence of inflammatory conditions, if she is free from all symptoms of such conditions. We must always bear in mind the necessity for excluding the presence of complications, but, with due knowledge of the symptoms arising from these conditions, it is usually always possible to do so in normal cases without subjecting the patient to a prolonged examination.

CHAPTER III

THE HYGIENE OF PREGNANCY

The Dietary—The Eliminatory Functions of the Body—The Use of Baths—Vaginal Douching—Dress—Coition—The Mental Condition and Surroundings of the Pregnant Woman—Surgical Operations during Pregnancy—The Care of the Breasts.

In considering the management and hygiene of pregnancy, it cannot be too strongly insisted upon that pregnancy is a physiological condition, and not a 'nine months' disease.' All that is necessary during normal pregnancy is to see that the ordinary physiological functions of the body are properly discharged, and that due attention is paid to the fulfilment of the physiological requirements of the body. It is a distinct misfortune when, in a normal case of pregnancy, a woman considers, or is led by her friends to consider, that she is a 'patient,' as such a consideration causes her to dwell too much upon her condition, and, perhaps, to alter her normal mode of living in a manner which may be far from advisable. The notion 'that a woman only escapes being ill twelve times a year by having an illness which lasts for nine months,' has been in the past responsible for many feminine derangements. We must not, however, be understood to mean by this that a woman during pregnancy may continue in all the occupations which she may follow at other times. The occupations which many women follow are very far from natural—that is to say, they involve habits and surroundings very different from those which are calculated to maintain the body in the natural hygienic conditions, and all such occupations are directly opposed not alone to the health of the woman, but to the health of her offspring. Giles aptly remarks that 'there is no doubt that in the majority of cases women require to be treated with an extra degree of consideration and indulgence during menstruation, whilst many are temporarily unfitted for arduous work or special exertion,'[*] a remark which is even more applicable to pregnancy. To slightly modify Ballantyne's[†] words:—The fact that our advice consists largely of the recommendation that all the laws of health, which apply to the non-pregnant condition, should be specially enforced in the pregnant state must not be interpreted as permission to the pregnant woman to continue disregarding many of the laws of health, just as she did when non-pregnant.

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[*] 'Menstruation and its Disorders,' p. 31.

[†] 'Antenatal Pathology and Hygiene,' p. 471.

1 The dietary of pregnancy should be simple, ample, and nourishing, and all indigestible foods should be avoided, but at the same time there should be no undue restrictions or excess. Plenty of fluid may be drunk, as it helps the action of the kidneys, but the excessive use of tea or coffee, as of alcoholic liquids, must be forbidden. A small quantity of alcohol may be taken daily if the patient is in the habit of doing so under other circumstances; but, on the whole, it is perhaps as well to limit its use as far as possible.

2 The regular action of the eliminatory functions of the body is of very great importance. If the skin, the kidneys, and the bowels do not act sufficiently, the most serious complications of pregnancy may arise. The patient should in all cases be warned of the importance of this, and especially of the importance of noting a sudden or gradual diminution in the amount of urine which is passed daily. If she is troubled by constipation, the regular action of the bowels should be ensured by the use of laxatives or mild purgatives. For this purpose, cascara sagrada, apenta water, or aloin may be recommended; but all drastic carthartics must be avoided, both on account of their weakening effect upon the patient, and the danger that they may interfere with the course of pregnancy. If the kidneys do not act sufficiently, the amount of fluid should be increased—particularly such fluids as barley-water or plain water, the action of the skin must be encouraged by hot baths or vapour baths and warm clothing, and perhaps elimination assisted by the administration of hydragogue purgatives.

3 The proper use of baths for purposes of personal cleanliness is also of importance. Whenever possible, a warm bath should be taken daily, and the genitals should be bathed night and morning with warm water, to which some mild antiseptic astringent, such as Sanitas, has been added. Extremes of temperature must be avoided, though, according to some authorities, if the woman is in the habit of taking cold baths in the morning, their use may be continued.

4 The question as to the advisability of, or the necessity for, vaginal douching during pregnancy is one on which we fancy most authorities in these countries are agreed that it is unnecessary and, hence, inadvisable save under special conditions. Abroad, however, there is a tendency in some quarters to recommend their use (Ribemont-Dessaignes). We have already discussed the habitual use of douches during labour, and all that is necessary to say here is that if they are not required during normal labour, they certainly are not required during normal pregnancy. If, however, the patient suffers from leucorrhœal

discharge, their use is frequently advisable as part of the treatment of the condition which gives rise to the discharge. In such cases, the douche should be administered at a low pressure, and should contain an unirritating and antiseptic astringent. A weak solution of Sanitas is well suited, and pyroligneous acid or a weak solution of sulphate of copper may also be used. If vaginal douching is ordered for a patient, the method in which the douche is to be administered must also be clearly specified, as it is most inadvisable to allow patients to use a douche unless they take the necessary precautions to ensure cleanliness in its administration. For personal use by the patient, a small metal or glass container, with a rubber connecting-tube, hung against the wall, or placed upon a stand two to three feet above the position which the patient's hips will occupy, are all that is required. A glass nozzle should be used, as it can be boiled. The douche-container and tube should be washed out after use with water, to which washing-soda has been added. The temperature of the douche should not exceed 98° F.

The dress during pregnancy should be such that pressure upon the abdomen is avoided. So far as possible, all under-clothing should be supported from the shoulders, and not round the waist. Corsets, if worn, must be so adapted to the figure that they give support, but do not exert compression. In most cases, and in all cases in which the abdomen is pendulous, or the recti widely separated, the use of a well-fitting abdominal belt, so adjusted as to support the abdomen from below, is advisable. Garters must not be worn, as they increase the tendency to venous congestion of the legs.

Regular exercise in the open air is a most essential part of the hygiene of pregnancy. The exercise should be of the same character as that to which the woman is accustomed at other times, with the restriction that violent exercises of all kinds should be forbidden. The question of the permissibility of bicycle-riding during pregnancy is one on which the medical man is often consulted. There can be little question that in the last few months of pregnancy it is unwise, and, indeed, there are but few women who would care to attempt it at such a time. In the early months, and on good roads, there does not seem to be any objection to it in a moderate degree, provided that it does not give rise to undue fatigue or to discomfort. In all cases in which it gives rise to breathlessness, or in which there is any tendency to venous congestion of the legs, it is inadvisable. In the case of multiparæ, the history of previous pregnancies will to a large extent guide us in the exercise which may be permitted. In the case of patients who have had previous abortions, sudden exertions must be prevented, so far as possible, and any exercise forbidden which necessitates sudden movements of the body as would occur in the case of bicycle-riding. In all cases, long standing or undue prolongation of exercise should be avoided.

7 The question of the permissibility of coition during pregnancy is an important one, although it is not always probable that medical advice in this respect will be acted upon. There is no question that in certain cases coition is inadvisable, and in all cases in which there is a history of previous abortion it should be strictly forbidden. Many authorities forbid it during the first four months. If the analogy of the lower animals and of many savage races is to be followed, coitus should be entirely forbidden. In this connection, we recommend a perusal of the remarks of Parvin.*

8 The mental condition and the surroundings of the pregnant woman are of importance, inasmuch as they largely influence her physical well-being and hence that of the fœtus. A pregnant woman should, as far as possible, be sheltered from all influences which tend to give rise to excitement, annoyance, or depression. The effect of maternal impressions on the fœtus is not yet clearly understood, but there can be no doubt that, if mental conditions are sufficient to interfere with the appetite, sleep, and general health of the woman, they must also prejudicially affect the fœtus. All amusements or occupations, which necessitate the presence of the woman in an atmosphere in which an undue amount of carbonic acid gas or carbon monoxide gas is present, must be rigidly forbidden, as the association between the accumulation of these gases in the blood and the liability to abort is well recognised. Similarly, all occupations which bring the patient into constant contact with certain poisons, notably lead, mercury, and phosphorus, must be temporarily abandoned.

9 The question of the permission of surgical operations during pregnancy is one on which the obstetrician is often called to give an opinion, and is closely connected with similar questions regarding exercise and coitus. In healthy patients, in whom there is no tendency to abort, and on whom the mental effect is not too strongly marked, the risk that a minor surgical operation will cause abortion is extremely small. If an operation can be postponed until a few months after the labour, without any prejudicial effect upon the health of the patient, by all means let it be postponed, but if the operation is called for to remove some condition which causes immediate suffering or ill-health, it should be performed. An anæsthetic should always be administered, and in this connection it may be mentioned that 'while there is no reason to doubt the passage of either chloroform or ether to the fœtus, neither is there any reason to apprehend toxic effects unless the maternal anæsthesia is deep and long-continued' (Ballantyne†).

10 The care of the breasts during pregnancy is of importance. At no time should the corset or other garment be allowed to press upon them, as this interferes with their development and prevents the formation of a proper nipple. During the last month

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* 'Science and Art of Obstetrics,' first edition, p. 212.

† *Op. cit.*, p. 269.

of pregnancy, the patient's attention must be directed to two points—the hardening of the skin of the nipple and the formation of a proper nipple. If this is not done, when she commences to suckle the infant she will find that the dragging of the latter will cause small lacerations and excoriations of the skin—conditions which are sometimes extremely painful, and that if the nipple is not properly formed the infant cannot take it in its mouth. In order to harden the skin, the nipples should be bathed with an alcoholic lotion a couple of times a day, such as whisky or equal parts of eau-de-Cologne and water. In order to form proper nipples, the woman should be taught to draw them out gently with her fingers several times a day. In so doing, no force must be used, and care must be taken that the fingers are clean. Rough manipulation may result in the occurrence of small lacerations, and, if these become infected, mastitis may follow.

PART IV

THE PHYSIOLOGY OF LABOUR

CHAPTER I

THE CAUSATION AND PHENOMENA OF LABOUR

Definition—Time of Onset of Labour—The Causes of Labour—The Stages of Labour—The Phenomena of Labour; The Contractions of the Uterus; The Contractions of the Accessory Muscles; The Effect of the Uterine Contractions on the Uterus, on the Pelvic Contents, on the Perinæum and Neighbouring Structures, on the Pelvic Bones, on the Ovum, on the Maternal System generally.

'Labour' is the term applied to the process which severs the connection between the ovum and the mother by removing the former from the organism of the latter.

As has been already seen, the average duration of pregnancy is 280 days, or forty weeks, or ten lunar months. Labour may, however, occur at any time during these ten months, or even after a longer period, as in the rare cases of protracted pregnancy. Accordingly, labour is divided into the following classes, in accordance with the period of pregnancy at which it occurs:—

(1) *Abortion.*—If labour comes on during the first four months of pregnancy—*i.e.*, before the full formation of the placenta—it is termed abortion.

(2) *Partus Immaturus.*—If labour comes on between the end of the fourth and the end of the seventh lunar month—*i.e.*, after the placenta has formed, but before the fœtus becomes viable—it is termed *partus immaturus*, or miscarriage.

(3) *Partus Prematurus.*—If labour comes on between the end of the seventh month and the end of the tenth month—*i.e.*, after the fœtus has become viable, but before full term is reached—it is termed *partus prematurus*, or premature birth.

(4) *Partus Maturus.*—If labour comes on at the end of the tenth month—*i.e.*, at full term—it is termed *partus maturus*, or full-term birth.

(5) *Partus Serotinus.*—If labour does not occur until after the end of the tenth month—*i.e.*, after full term—it is known as *partus serotinus*, or delayed birth.

The Causes of Labour.—The immediate cause of labour is the occurrence of uterine contractions, as it is to these that the expulsion of the ovum is due, and under normal circumstances these contractions occur at the end of the tenth month. Accordingly, our inquiry into the causes of labour resolves itself into two questions:—What causes uterine contractions? Why do they normally occur at the end of the tenth month?

As we have already seen, the uterus is innervated by three sets of ~~nerves~~:—

(1) A set derived from the cord through the sacral nerves, and under the control of one centre in the medulla oblongata, and of another in the lumbar spine.

(2) A set derived from the aortic, mesenteric, and hypogastric sympathetic plexuses, which join the uterine plexus in front of the aorta.

(3) A set derived from independent ganglia (~~Dembo's gang~~lia) situated near the anterior vaginal fornix (Schaeffer).

Stimuli are carried to the uterus through these nerves as the result of direct irritation of the motor centre in the medulla, or of reflex irritation of the centre in the lumbar cord or of the sympathetic ganglia. P ~~Direct irritation~~ of the motor centre in the medulla is known to be caused by certain substances circulating in the blood—1 excess of CO_2, quinine, ~~sodium salicylate~~, ergot, strychnine, and other drugs; 2 by sudden or extreme elevation of temperature; and 3 by the occurrence of profuse hæmorrhage. Reflex irritation of the lumbar centres, or of the sympathetic ganglia, can be caused by 1 dilatation of the cervix uteri, 2 detachment of the membranes, 3 excess of CO_2 in the blood in the uterine sinuses, 4 irritation of the breasts, and, possibly, the monthly irritation associated with the menstrual cycle, even though menstruation itself is temporarily latent. Any of these stimuli may be the cause, or one of the associated causes, of the onset of uterine contractions. It is not even necessary that there should be a connection with the brain or the centre in the medulla, as has been proved not only experimentally, but also clinically, in cases in which the spinal cord had been severed above the lumbar region by tumours.

It is a very much more difficult matter to determine why uterine contractions occur normally at the end of the tenth month. Indeed, it is doubtful that any explanation which can be given at the present time can be regarded as quite satisfactory. It is very improbable that there is any one definite cause for the onset of uterine contractions at full term. We have seen that there are a considerable number of separate agencies by which uterine contraction can be provoked, and it is most likely that the onset of full-term labour is due to an association of several of them. If it was otherwise, and if the normal onset of labour was due to one factor alone, it would be difficult to account for its regularity, as there is no agency of which we at present know which is always present in the same degree. The normal agencies which assist in causing uterine contractions at full term, and the manner in which they occur, are, in all probability, as follows:—

(1) *Dilatation of the Cervix.*—In the early months of pregnancy, increase in the size of the uterus is caused and accompanied by

hypertrophy of its walls. Consequently, instead of a thinning of the uterine walls taking place, there is an actual increase in thickness. In the later months, on the other hand, further increase in the size of the uterus is obtained at the expense of the thickness of the uterine walls, and the latter become thinned and tense. As this process cannot continue indefinitely, it is plain that a time must come at which the uterus commences to offer an obstacle to the increase in size of the ovum and to press the latter against the lower uterine segment and the internal os. This brings about a commencing dilatation of the internal os, and so creates one of the agencies by which contractions are provoked. It has been suggested by certain writers that this, perhaps, is the agency, and that it is unnecessary to look further for others. That this cannot be so is, however, sufficiently obvious from the fact that in some cases—*e.g.*, twins or hydramnios—the uterus will bear an extreme degree of dilatation without reaction. That it is a possible agency is also obvious, if we consider the result of artificial dilatation of the cervix during pregnancy.

(2) *Detachment of the Membranes.*—The theory that separation of the membranes occurs during the last month of pregnancy as a result of degenerative changes in the decidua has been looked on with favour by many authorities. Such a change may be due to fatty degeneration (Simpson, Schroeder), or to a coagulation necrosis which gives rise to a fibrinous transformation or degeneration (Webster). If sufficient change takes place in the decidua to cause the detachment of the membranes, an agency in the causation of uterine contractions is undoubtedly created. In practice, we find that the manual or instrumental separation of the membranes is almost always followed by labour. It would appear as if the ovum in such cases became akin to a foreign body and caused a peripheral irritation of the nerve endings. In addition to fatty degeneration or coagulation necrosis of the decidua, the formation of the lower uterine segment may also cause the detachment of the membranes which form the lower pole of the ovum.

(3) *Excess of CO_2 in the Uterine Sinuses.*—The appearance of large nucleated masses in the decidua serotina has been noted during the fifth month of pregnancy. These masses, which are probably derived from the syncytium, increase in number during the following months, and, about the eighth or ninth month, are said to grow into the veins which carry the return flow of blood from the placenta (Friedländer, Leopold) and to produce a partial blockage of them. This necessarily results in a slowing of the circulation of blood through the uterine sinuses, and hence in the accumulation in this blood of an increased amount of CO_2. The effect of an excess of CO_2 when contained in the placental blood has been shown by Hasse,* while Runge† attributes the occur-

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* Hasse, *Zeitschrift f. Gynäk. und Geburtsh.*, vi. 1, 1881.

† Runge, *Ibid.*, iv. 71, 1881; *Centralb. f. Gynäk.*, 1883, No. 21, 329.

rence of contractions not so much to the excess of CO_2 as to the accompanying lack of oxygen.

(4) *Excess of CO_2 in the General Circulation.*—An increased proportion of CO_2 in the general circulation naturally tends to occur towards the end of pregnancy, in consequence of the ever-increasing quantity of oxygen used by the growing fœtus. There is good reason to consider that excess of CO_2 will cause the onset of labour in consequence of the comparative frequency with which fatal cases of poisoning by this agency have, in the case of pregnant women, been attended by the expulsion of the fœtus. Further, Brown-Sequard excited contractions of the uterus in the case of pregnant animals by this means. It is probable that this effect is produced by the direct action of CO_2 on the motor centre in the medulla, but a reflex action through the uterine nerve endings, as has been described, may also take place.

(5) *Menstrual Irritation.*—All through pregnancy, the uterus shows by the occurrence of painless contractions that it possesses a certain degree of irritability. As a rule, these contractions are more marked at each menstrual period, thus showing that the nervous mechanism of menstruation is still active to a slight degree even though menstruation itself is latent. This monthly irritability of the uterus, though not sufficient in itself to cause the onset of true uterine contractions, furnishes an agency which, in association with others, may be capable of determining the date of their commencement.

Accordingly we see that, in association with a normal pregnancy, there are a number of changes in the maternal organism and in the ovum, which become daily more marked and which apparently tend to reach a climax and to cause uterine contractions. The fact that one of these phenomena—*i.e.*, the occurrence of painless contraction—is most marked at the periods of latent menstruation, helps to explain why the climax should coincide with a menstrual period. Why the tenth menstrual period after conception should be fixed upon can, we consider, be best explained as Bland-Sutton explains the periodicity of menstruation:—As the cardiac cycle is about one second, and the respiratory cycle about four seconds, so the menstrual cycle is about four weeks and the human gestation cycle about ten lunar months. It may also be explained by saying that the human fœtus is so constituted that at an age of ten months it no longer requires, or is suited for, intra-uterine life, and that the various phenomena we have recounted, and probably others as yet unascertained, are so co-ordinated that they procure its expulsion at this particular time in a similar manner as the cardiac and respiratory rhythms are co-ordinated to supply the higher nerve centres with their necessary proportion of oxygen, etc.

The Stages of Labour.—Labour is divided into three stages, which, as will be presently seen, are not mere arbitrary divisions, but are defined by the occurrence of special phenomena peculiar to each stage. The first stage comprises the period during which the cervical canal is dilating in order to allow the passage of the fœtus. It is hence also known as *the stage of dilatation.* It ~~commences with the~~ onset of the first painful contraction of the uterus, and ends with the full dilatation of the uterine orifice —an occurrence with which the rupture of the enveloping membranes of the ovum is usually synchronous. Its average length is in primiparæ from eight to twelve hours, in multiparæ from six to eight hours. The second stage comprises the period during which the fœtus is being expelled from the genital passages. It is hence also known as *the stage of expulsion.* It commences immediately the first stage is completed, and ends with the birth of the fœtus. Its average length is in primiparæ from one to two hours, in multiparæ from ten to fifteen minutes. The third stage comprises the period during which the remainder of the ovum—*i.e.*, the placenta and the membranes—is being expelled. It is hence known as *the placental stage.* It is difficult to state what would be its average length if the process of expulsion was left wholly to the natural efforts, as this, for reasons which will be presently mentioned, is never done. It is usually stated that under such circumstances the placenta would be expelled in from one to three hours, but this is probably too short an estimate. If, however, the usual method is adopted of waiting until the placenta has been detached and expelled from the uterus by the natural efforts, and then expressing it from the vagina by pressure applied over the supra-pubic region, the average duration of the stage is from twelve to ~~fifteen minutes~~.

THE PHENOMENA OF LABOUR

Before entering into the discussion of the various phenomena of labour, we shall define certain terms which will be frequently used. These terms are as follows:—

Contraction.—By this term is meant the temporary shortening of a muscle fibre which occurs in response to a stimulus conveyed to it by an efferent nerve.

Retraction.—By this term is meant the permanent shortening of the muscle fibre which persists after the contraction has passed off.

Relaxation.—By this term is meant the condition of the muscle fibre in the absence of contraction.

Polarity of the Uterus.—By this term is meant the correlation which exists between the contractions of the fundus of the uterus and those of the cervix. Prior to the onset of labour, the muscle fibres of the body of the uterus are relaxed and those of the cervix contracted. After the onset of labour, the contraction of the muscle fibres of the body are simultaneous with a relaxation of those of the cervix.

(e.) *Uterine Orifice.*—This term is used to denote the passage which lies between the uterine cavity and the vagina at any stage of labour. The exact nature of this passage differs at the different stages of labour. At one time, it comprises the entire cervical canal, while at other times it only includes portions, which vary according to the number of children the woman has previously borne.

(f) *The Taking-up of the Cervix.*—This is the term applied to the gradual process by which the cervical canal is made continuous with, and so part of, the lower uterine segment.

It will probably help the student to understand the many undoubtedly puzzling and complex phenomena of labour if we first briefly summarise these phenomena in a short account of the process of labour. The extraordinary changes, which take place in the uterus and its contents during the twelve to twenty-four hours in which a normal labour is completed, necessitate the occurrence of phenomena of a magnitude greater than that of any other physiological phenomena met with in the human body. At the commencement of labour, the fœtus floats in the liquor amnii in a closed sac formed by the membranes, and this sac in turn is contained in another closed sac—the uterus. The connection between the sac formed by the membranes and the investing uterus is but slight, save at one point—where the placenta is attached to the uterine wall, and here large bloodvessels pass from the uterus into the placenta. In order that the fœtus may escape from the sac in which it is contained, the membranes must rupture, and, in order that it may pass out of the investing uterus, the cervical canal must dilate to a sufficient size to allow it to pass through. Further, a powerful force is necessary in order to expel the fœtus from the uterus, and to overcome the resistance which is offered to its passage by the maternal tissues. Finally, the placenta has to be detached and also expelled from the uterus, and, as this occurs, some mechanism has to come into play which will obliterate its supplying vessels, and so prevent the hæmorrhage which would otherwise occur.

These various changes are brought about as follows:—With the commencement of labour intermittent contractions of the uterus occur, with the result that the elastic ovum is compressed. The compressing force is greater above and at the sides, and least below, and, consequently, the ovum bulges downwards against the lower portion of the uterus. *Pari passu* ~~with the inter~~mittent contractions, the polarity of the uterus shows itself, and the fibres of the cervix relax. Then, as a result of the pressure of the ovum and of the relaxation of the cervical fibres, the uterine orifice slowly dilates. As soon as this dilatation has reached a stage sufficient to allow the head to pass through, the membrane tears, in consequence of the pressure transmitted to them from the uterine contractions, and of the loss of the previous support which they had received from the lower pole of the uterus and the walls of the cervix. The first stage of labour is now said to be complete, and the second stage commences. The passage through which the fœtus is to pass is now ready for it. The uterine contractions, instead of merely causing the dilatation of the uterine orifice, begin to expel the fœtus from the uterus, and, in obedience to a natural impulse which calls on her to supplement them, the patient 'bears down,' or, in other words, she endeavours by means of the accessory muscles of labour—*i.e.*, almost all the important voluntary muscles in her body—to increase the intra-abdominal pressure, and so to increase the force which is driving the fœtus out of the uterus. As a result of these forces, the fœtus is driven into the pelvis, where room has been in part already made for it by the displacement upwards of certain of the pelvic structures—notably the bladder. As the fœtus descends, it makes more room for itself by driving the greater part of the remaining structures downwards before it. The relations of the bony pelvis also undergo certain alterations, which result in a temporary increase in various diameters. The presenting part then reaches the vulva, and, passing through the latter, is born, and is quickly followed by the rest of the body. With the birth of the fœtus, the second stage is completed. The final step of labour consists in the expulsion of the remainder of the ovum—*i.e.*, the placenta and the membranes. This process is again brought about by the contractions of the uterus, and, as a result of these, the uterus diminishes so much in size that the placenta is detached, and is expelled from the uterine cavity, while as a result, not only of the contraction of the uterus, but still more of its retraction, the bloodvessels which run into the placenta are so compressed and kinked that any further hæmorrhage through them is prevented.

We thus see that the principal phenomenon of labour, to which almost all the other phenomena are due, is the occurrence of uterine contractions, helped by the contractions of the accessory muscles of labour.

The Contractions of the Uterus.—The nature of the contractions of the uterus is so intimately connected with the anatomy of the muscle of that organ, that we consider it necessary to recapitulate a little of what has gone before. From an obstetrical point of view, the uterus is composed of three parts or zones (*v.* Fig. 143):—

(1) *An Upper Zone—the Upper, or the Contractile, Uterine Segment.*—This zone contains that portion of the uterine muscle whose contractions effect the expulsion of the fœtus. It is composed of fibres which run in all directions, and is completely covered by firmly attached peritoneum.

(2) *A Lower Zone—the Lower, or Non-contractile, Uterine Segment.*—This zone lies between the upper uterine segment and the inner os. The junction between the upper and lower segments is termed the 'retraction ring,' and corresponds to the place at which the structure and arrangement of the muscle fibres peculiar

to the upper segment ends. This takes place at a level coincident with the line of reflexion of the peritoneum off the anterior face of the uterus, and also to the entry of the uterine artery. The muscle fibres of the lower zone are very loosely connected with one another, and run some circularly and others longitudinally. The circular fibres, in accordance with the property of so-called polarity of the uterus, relax *pari passu* with the contractions of the upper uterine segment, while the longitudinal bands, by their contractions, draw the cervix upwards over the advancing ovum. There is no peritoneal covering in front of this segment, while

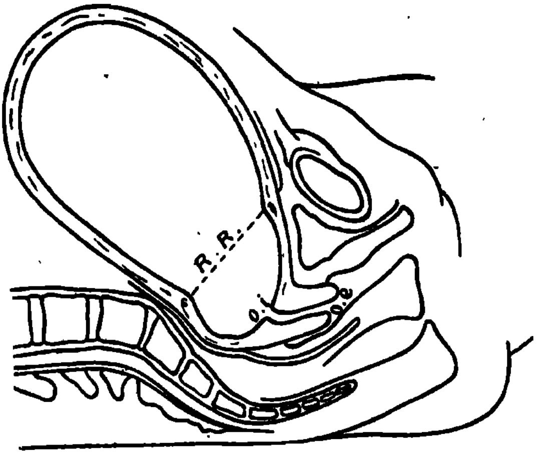

FIG. 143.—DIAGRAM SHOWING THE APPROXIMATE POSITION OF THE RETRACTION RING (RR) AT THE COMMENCEMENT OF LABOUR.

Above RR is the upper uterine segment, below RR the lower uterine segment. *oi*, Os internum; *oe*, os externum.

posteriorly the peritoneal attachment is loose, thus contrasting markedly with the covering of the upper segment.

(3) *The Cervix.*—This zone comprises that portion of the uterus which lies below the inner os. It also contains circular fibres, which act similarly to those found in the lower segment.

Accordingly, we see that the uterus is a most complexly formed hollow muscle. During pregnancy, it is in a condition of relaxation, save so far as the circular fibres of the cervix are concerned, and they are in tonic contraction. As soon as labour commences, the condition is reversed. The fibres of the upper segment and the longitudinal fibres of the lower segment contract, and the circular fibres of the lower segment and of the cervix simultaneously relax.

The contractions of the uterus possess four characteristics:—they are intermittent, peristaltic, involuntary, and painful.

At the commencement of labour, contractions occur only at long intervals, a period of perhaps an hour elapsing between each. As the first stage proceeds, they become more frequent, and occur on an average every twenty minutes during the taking-up of the cervix, and every two to three minutes during the dilatation of the uterine orifice (Ribemont-Dessaignes). During the second stage, they occur at first every five to ten minutes, and increase in frequency, until during the birth of the fœtus they are almost continuous. After delivery, the contractions, as a rule, cease for from five to fifteen minutes, and then again recur every five minutes or so, until the placenta has been detached and expelled from the uterus. The duration of a contraction varies in accordance with the stage of labour. At the commencement of labour a contraction lasts a few seconds, and gradually increases in duration until during the second stage it lasts from thirty to ninety seconds.

It is probable that the uterine contractions are peristaltic in character, but this has not been definitely determined. Kehrer has observed a peristaltic character in the contractions of the uterus in animals, and Von Herff in women during Cæsarean section. On the other hand, many observers deny this, and even among those who admit it, the direction in which the wave travels has not been agreed upon. According to some, it commences at the cervix and passes upwards, but the more general opinion is that it commences in the region of the tubes and passes downwards towards the cervix. The time occupied by the peristaltic wave in spreading over the uterus, in proportion to the total duration of the contraction, is small. The pain, as a whole, lasts from sixty to ninety seconds, and the peristaltic action from twenty to thirty seconds (Schatz).

The involuntary character of the contraction is common to all unstriped muscle fibre. The occurrence of contractions is, however, affected by nervous influences, such as may arise from the presence of a stranger in the room, dread of pain, and such-like causes.

The painful nature of uterine contractions—a fact to which the term 'pain' as applied to these contractions owes its origin—is one of their most marked characteristics. The pain occurs at the height of the contraction, which commences and ends painlessly. Its site, cause, and nature vary according to the period of labour. The preliminary pains—*dolores præsagientes*—which usually usher in labour are very irregular in their occurrence, and are felt over the abdomen generally. They are not severe in character, and are probably due to the increased force of the hitherto painless uterine contractions and to commencing dilatation of the cervix. During the first stage of labour, the pain is principally referred to the region of the sacrum, and to a slighter extent to the sides of the uterus. It is chiefly due to the stretching of the cervix, and to a less extent to the contractions of the uterus, and is of a dull, and aching character. With the advent of the second stage, and the increase in the strength of the uterine contractions, the pain becomes more severe. It is felt in the uterus, due to the compression of nerves situated in the uterine wall; in the sacrum and pelvis generally, due to the stretching of the vagina and perinæum; and in the thighs and legs, due to pressure upon the sacral plexus. During this stage, the pain grows in severity, and reaches a climax during the passage of the head over the perinæum, when it is described as being of a violent tearing or cutting character. During the third stage, the pains are felt principally in the uterus, and are probably due to the compression of the uterine nerves. As a rule, they are not severe.

Various terms have been used from time to time to imply the character of the pains which occur at different periods of labour. 1 The preliminary pains are termed false pains, *dolores presagientes*, or premonitory pains. 2 The pains which occur during the first stage are termed *dolores præparantes*, or preparatory pains. 3 The earlier pains of the second stage are termed expulsive pains, or *dolores ad partum*, 4 while the final pains of this stage are termed *dolores conquassantes*, or shivering pains, owing to the quivering of ~~the lower~~ limbs which sometimes accompany them. 5 The pains which occur during the third stage are known as the after-birth pains, or *dolores ad secundines*. 6 Finally, the pains which occur during the days subsequent to delivery are termed after-pains, or *dolores post-partum*.

Various attempts have been made to determine the strength of a uterine contraction—*i.e.*, the compression-force it exerts on the unruptured bag of membranes, or with which it drives the fœtus downwards, and the most contradictory results have been obtained. Schatz determined that the intra-uterine pressure, as measured in the region of the internal os, varied from 17 to 55 pounds. Ribemont-Dessaignes ascertained that a force of from 10,660 to 11,179 grammes (23·5 to 24·6 pounds) was required to rupture the fœtal membranes. According to Matthews Duncan, the force required varies from 4½ to 36 pounds,[*] with an average force of 15 pounds. While Leaman, by means of a special instrument, found that when the force with which the head was advancing through the pelvis did not exceed two pounds, the fœtus subsequently required to be extracted by means of the forceps. These figures possess no practical importance, and, indeed, it is difficult to see how a means of measuring the force of the uterine contractions which would give results of practical importance could be devised, or which would measure anything save the difference between the strength of the contractions of the uterus and the resistance to the advance of the soft parts. Clinically, it would appear as if the force of the contraction depended upon the resistance offered to the descent of the presenting part, and

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[*] 'Researches in Obstetrics,' p. 299.

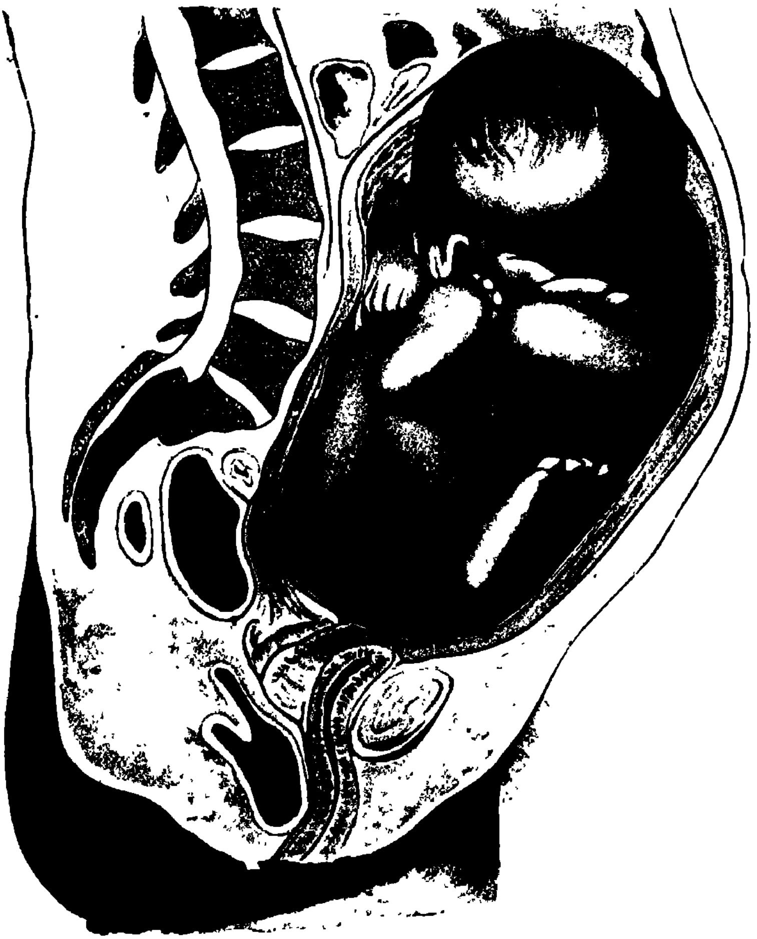

PLATE I.—MESIAL SAGITTAL SECTION OF A PRIMIPARA WHO DIED AT FULL TERM, BUT BEFORE THE COMMENCEMENT OF LABOUR.

Note the condition of the cervix and the attitude of the fœtus. (Waldeyer.)

[*To face p.* 263.

that it varied considerably throughout labour. Both these probabilities have, however, been denied by various authorities.

The round ligaments contract synchronously with the uterine muscle, of which they must be regarded as an extension. Their effect is to draw the uterus downwards, and so to counteract the tendency of the fundus to rise upwards.

The Contractions of the Accessory Muscles of Labour.—The accessory muscles, which come to the aid of the uterine muscle during the period of expulsion, are composed of almost all the important voluntary muscles of the body. Primarily, they consist of those muscles which can aid in diminishing the size of the abdominal cavity; while, secondarily, they consist of the muscles of the limbs, which assist in fixing the thorax and pelvis, and so furnish the other muscles with a *point d'appui*. It is unnecessary to enumerate the muscles which are included in the first group. Speaking generally, they consist of the muscles which aid in closing the glottis, of the diaphragm, of the other muscles of expiration, and of the muscles of the abdominal wall. The effect of the contraction of the auxiliary muscles is to cause a uniform pressure over the body of the uterus, and so both to expel the uterine contents and also to drive the uterus as a whole downwards. The latter action is of importance, inasmuch as it tends to prevent the excessive thinning of the lower uterine segment which might occur if the upper segment was free to rise upwards, as its tendency is, in the abdominal cavity.

The Effect of the Uterine Contractions on the Uterus.—The uterine contractions must be studied in relation to their effect on the uterus, the pelvic contents and perinæum, the pelvic bones, the ovum, and the maternal system generally. The first effect of the contractions on the uterus is to cause a considerable temporary diminution in size in the cavity of the uterus due to contraction of the muscle fibres, and a slight, but progressive and permanent, diminution, due to retraction of the fibres. During a contraction, the longitudinal diameter of the uterus is increased, owing to the expansion of the lower uterine segment. At the same time, the transverse diameters are diminished, and the wall is increased in thickness, the total result being a diminution in the size of the cavity. As a result of this diminution, the ovum is compressed, and so is compelled to find room for itself by bulging in whatever direction the resistance offered to it is least. This area of least resistance is found in the neighbourhood of the os internum, a fact which is accounted for mainly by the anatomical and physiological peculiarities of the lower uterine segment. As will be remembered, the muscle fibres are differently arranged, and are fewer at this part of the uterus than they are in the remainder of the body; and, further, as a consequence of uterine polarity, they relax *pari passu* with the contractions of the fundus. To a slight extent, two other factors also assist in making the lower uterine segment the area of least resistance.

These are the pressure of the abdominal contents and wall upon the remainder of the uterine body, and the influence of gravity on the ovum while the patient is in the erect posture. The continuance of uterine contractions leads to the following important changes:—

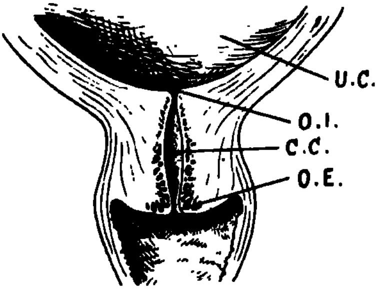

FIG. 144.—THE CERVIX IN A PRIMIPARA AT THE COMMENCEMENT OF LABOUR. UC, Uterine cavity; OI, os internum; CC, cervical cavity; OE, os externum.

(1) The taking up of the cervix.
(2) Dilatation of the uterine orifice.
(3) Expansion of the lower uterine segment.
(4) Diminution in size of the upper uterine segment.

(1) *The Taking-up of the Cervix.*—The taking-up of the cervical canal into the lower uterine segment is a process which differs in detail and in degree in the case of primiparæ and multiparæ. In both cases, the mechanism by which it is accomplished is the same, and consists in the softening which has been progressively taking place in the cervical tissues during pregnancy; in the contractions of the longitudinal fibres of the uterus which draw up

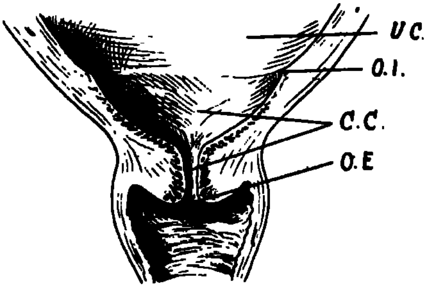

FIG. 145.—THE TAKING-UP OF THE CERVIX IN A PRIMIPARA.
The upper portion has been taken up. UC, Uterine cavity; OI, os internum; CC, cervical cavity; OE, os externum.

the cervix over the advancing ovum; and in the contractions of the upper uterine segment which drive the ovum downwards.

In primiparæ, at the commencement of labour, the cervix presents more or less its characteristic outline and length, and both the internal and external os are closed. The process of taking-up closely resembles the effect which would be produced by pushing a cone through the cervical canal from above downwards (*v.* Figs. 144-147). First, the internal os dilates, and its outline is practically lost. Then the supravaginal portion of the cervical canal dilates in the same manner, and then the infra-

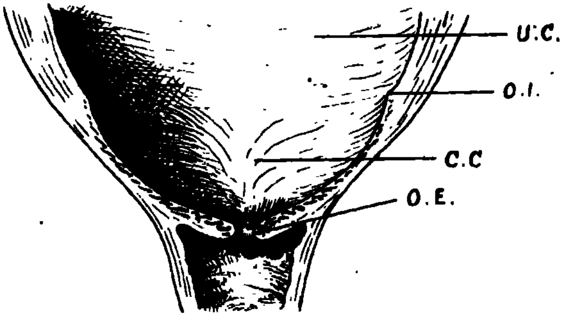

FIG. 146.—THE TAKING-UP OF THE CERVIX IN A PRIMIPARA.
The taking-up is almost complete, but the uterine orifice is still undilated. UC, Uterine cavity; OI, os internum; CC, cervical cavity; OE, os externum.

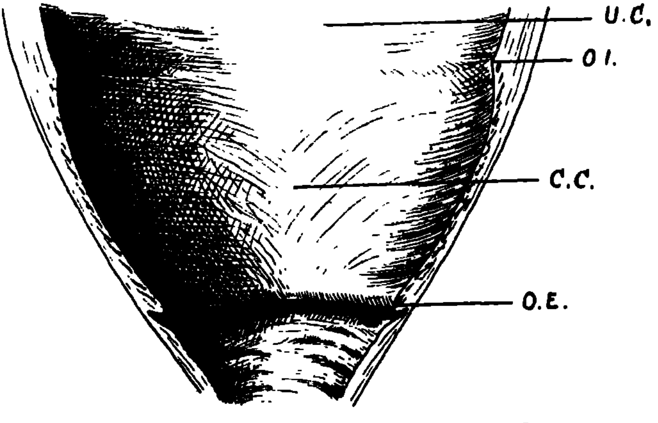

FIG. 147.—THE TAKING-UP OF THE CERVIX IN A PRIMIPARA.
The taking-up is complete, and the uterine orifice is fully dilated. UC, Uterine cavity; OI, os internum; CC, cervical cavity; OE, os externum.

vaginal portion. The taking-up of the cervix is now complete, the uterine and cervical cavities are continuous with one another, and the uterine orifice is alone enclosed by the thinned-out edges of the external os.

In multiparæ, on the other hand, the cervix has at the commencement of labour lost its original contour to a varying extent.

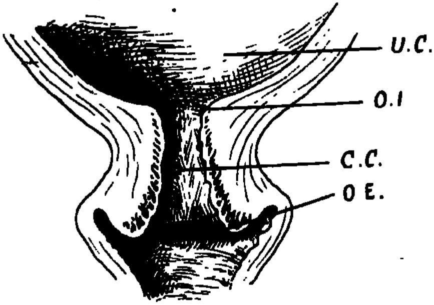

FIG. 148.—THE CERVIX IN A MULTIPARA AT THE COMMENCEMENT OF LABOUR. UC, Uterine cavity; OI, os internum; CC, cervical cavity; OE, os externum.

The external os is already patulous, and will admit one or two fingers, so that whereas in primiparæ the upward passage of the examining finger is checked by the resistance of the external os; in multiparæ it is checked by the resistance offered by the supravaginal portion of the cervix, or even by the internal os. This is probably due to the increased degree of softening which is present in these cases, and also to the effect of former lacerations and consequent ectropion. In such cases, the taking-up of the cervix is not so complete as in primiparæ (*v.* Figs. 148-150). The first step consists in the dilatation of the internal os, followed

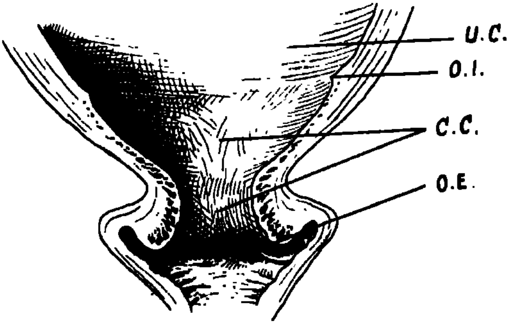

FIG. 149.—THE TAKING-UP OF THE CERVIX IN A MULTIPARA. The upper portion has been taken up. UC, Uterine cavity; OI, os internum; CC, cervical cavity; OE, os externum.

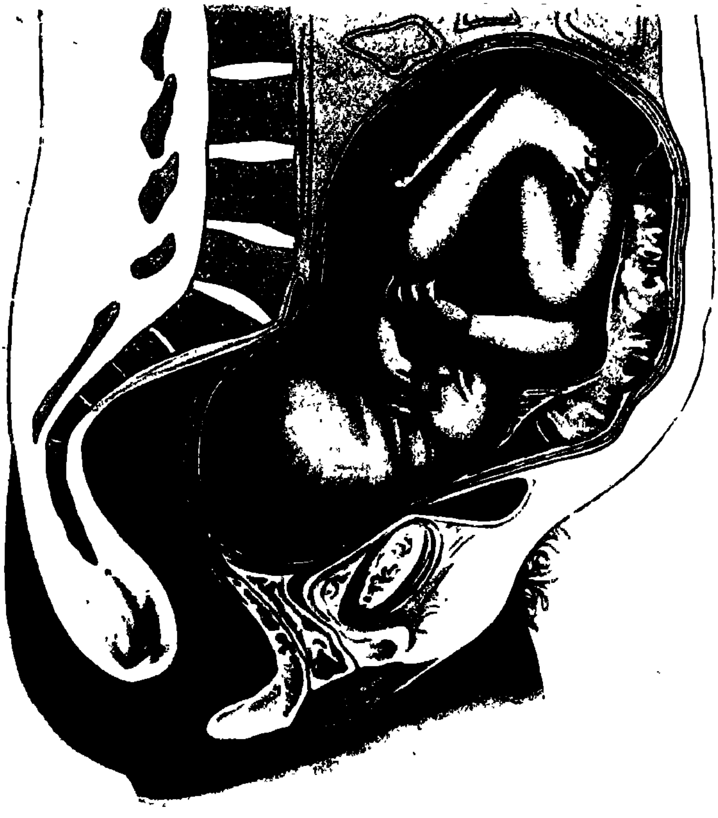

PLATE II.—MESIAL SAGITTAL SECTION OF A PRIMIPARA WHO DIED DURING THE FIRST STAGE.

The transverse position of the head is accounted for by the fact that the pelvis measured only 3·6 inches in the true conjugate. Note the taking up of the cervix. (Saexinger.)

[*To face p.* 267.

by the dilatation of the supravaginal portion of the cervical canal. The process of taking-up is now complete, and the uterine orifice is enclosed by the greater part of the infravaginal portion of the cervix. Consequently, whereas in primiparæ the uterine orifice is encircled by the thin, almost paper-like, edges of the os externum, in multiparæ it is encircled by blunt, comparatively thick edges, formed by the lower half of the cervical tissues.

(2) *The Dilatation of the Uterine Orifice.*—The dilatation of the uterine orifice is brought about by the expansile pressure exerted on its edges by the wall of the ovum, and by the contractions of the longitudinal bands of muscle fibre, which draw the remaining portion of the cervix upwards. As soon as this upward retracion of the cervix is so complete that almost all trace of cervical rojection has disappeared, dilatation is complete, and the uteroervical and vaginal cavities are continuous. During the dilataion of the cervix, the cervical glands pour forth large quantities f mucus, which materially facilitates the expulsion of the fœtus y its lubricating effect on the walls of the genital canal.

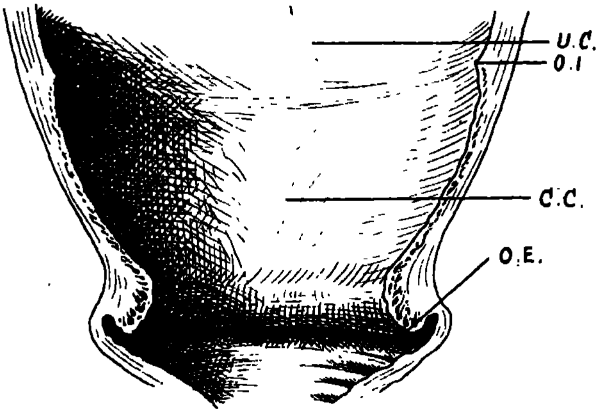

FIG. 150.—THE TAKING-UP OF THE CERVIX IN A MULTIPARA.

he taking-up is almost complete, and the uterine orifice is almost completely dilated. UC, Uterine cavity; OI, os internum; CC, cervical cavity; OE, os externum.

(3) *The Expansion of the Lower Uterine Segment.*—The changes which take place in the lower uterine segment during labour, onsequent on the occurrence of uterine contractions, are not only amongst the most interesting phenomena of labour, but are of the greatest practical importance. As we have seen, at the commencement of labour the lower uterine segment comprises the zone between the retraction ring and the os internum, and is

about 2¾ inches in depth.* When the taking-up of the cervix is complete, the lower uterine segment is increased in size by the added portion of the cervical tissues. Above the retraction ring, the uterine muscle contracts and retracts during labour. Below it, the muscle relaxes, with the exception of the longitudinal bands which draw the cervix upwards. With each contraction of the uterus, the capacity of the upper segment diminishes, while the capacity of the lower segment increases owing to the descent of the ovum. The combined effect of these changes in the upper and lower segments is to produce an actual elongation of the uterus, which persists even after the head has passed completely into the pelvis, so that, according to Fothergill, the average height of the fundus above the pubis is 9·5 inches during the first stage, and 9·8 inches at the end of the second stage. At first, this diminution in size of the upper segment occurs and passes off with each contraction; but, as labour continues and retraction becomes more marked, each contraction leaves the cavity of the upper segment slightly smaller than it was before. It is obvious that, so long as the fœtus is completely contained in the uterus, this gradual diminution in size of the upper segment must be accompanied by a corresponding increase in size in the lower segment. This, under normal circumstances, is obtained by the taking-up of the cervix, and as soon as this process is complete and the uterine orifice dilated, the advance of the fœtus renders further expansion unnecessary. If, however, there is any obstacle to the birth of the fœtus, then the progressive retraction of the upper segment necessitates an increased amount of expansion of the lower segment. The greater this obstacle is, and, consequently, the longer labour continues, the greater is the increase in size of the lower segment, until, finally, if labour continues sufficiently long, the lower uterine segment becomes so thinned by expansion that it yields to the pressure of the fœtus, and a rupture of the uterus occurs (*v.* Fig. 151). The junction between the upper and lower segments is known variously as the retraction ring, the contraction ring, and as Bandl's ring. The last term should not be applied to it, as it is definitely associated with the theory of Bandl regarding the formation of the lower segment and the situation of the ring. We agree with Barbour that the term retraction ring is the most suitable, inasmuch as the ring is the result of the progressive and permanent occurrence of retraction, and not of the temporary occurrence of contraction. In consequence of the diminution in size of the upper segment, the ring progressively rises towards the fundus of the uterus. In normal cases the ring is not apparent, but in cases of prolonged labour the retraction ring may be actually felt through the abdominal walls as a depression running obliquely across the uterus, at first a little above the symphysis, and, finally, perhaps in the region of the umbilicus. Accordingly, we see that the position of the retraction ring, if it can be ascertained, affords a positive indication of the effect of the contractions on the uterine muscle fibre.

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* Schroeder-Stratz: Frozen section.

The functions of the lower uterine segment are two in number. In the first place, as will be readily understood, but for its existence, the uterine contractions could not bring about the expulsion of the fœtus. If the entire uterus was composed of an identical arrangement of muscle fibre, the contraction of the latter would merely tend to compress the ovum. When, however, the lower segment of the uterus contains fibres which apparently act in opposition to the fibres of the upper segment, and so provide a place into which the contractions of the latter can drive the ovum, its expulsion from the uterus is possible. Consequently, the first function of the lower segment is to facilitate the expulsion of the fœtus. The second function of the lower uterine segment consists in forming a ring, which prevents the descent of the presenting part until the uterine orifice is sufficiently dilated to allow the latter to pass. Into this ring, the presenting head is driven by each contraction in such a manner that the two together act as does a ball-valve. As has been already explained, this action is very important. Prior to each contraction of the uterus, the liquor

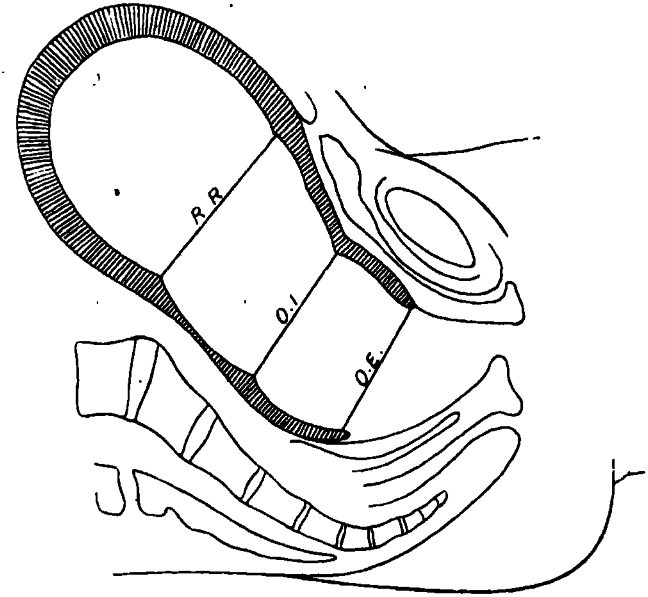

FIG. 151.—DIAGRAMMATIC SECTION OF THE UTERUS AFTER PROLONGED LABOUR, TO SHOW THE POSITION OF THE RETRACTION RING.

RR, Retraction ring; OI, internal os; OE, external os.

amnii which surrounds the body of the fœtus is in free intercommunication with the liquor amnii which lies in front of the head. If this intercommunication was to persist during a contraction, the result would be that a great quantity of liquor amnii would be forced in front of the head, and that, in consequence, the tension on the membranes lying over the dilating cervix would be so great that they would rupture long before the uterine orifice was dilated. Instead of this, however, the contraction drives the head so firmly into the embrace of the lower segment that all communication between the hind-waters and the fore-waters is temporarily shut off, and that, consequently, the tension on the membranes is only increased in proportion as the head descends. This ball-valve action is further of importance at the time the membranes rupture, inasmuch as it prevents the escape of the liquor amnii which surrounds the body of the fœtus. But for it, as soon as the membranes ruptured, the liquor amnii would all flow away with, perhaps, sufficient force to carry with it the cord. This function of the lower segment is not accepted by all authorities. On the contrary, many, notably Galabin* and Dakin,† consider that so far from the presenting head accurately fitting

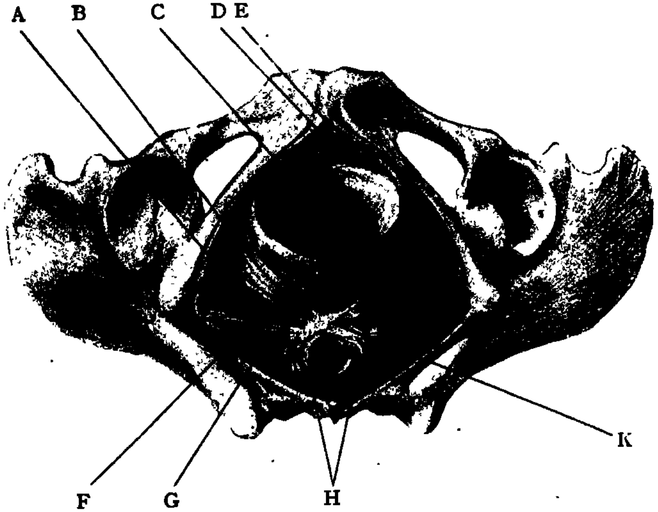

Fig. 152.—The Muscles of the Pelvic Floor shown at the Commencement of Dilatation by the Fœtal Head.

A, Erector clitoridis; B, constrictor vaginæ; C, vagina; D, urethra E, clitoris; F, transversus perinæi; G, levator ani; H, sphincter ani; K, central point of perinæum. (Bumm.)

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* 'A Manual of Midwifery,' p. 165.

† 'A Handbook of Midwifery,' p. 106.

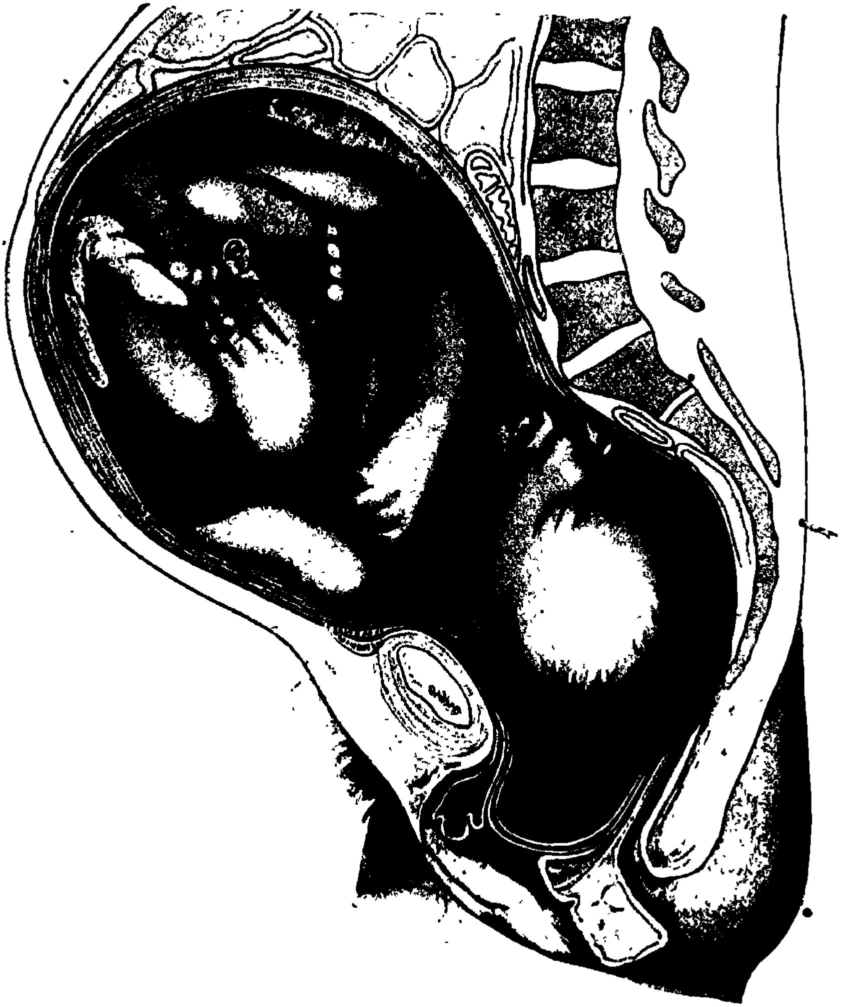

Plate III.—Mesial Sagittal Section of a Primipara who died during the Second Stage, but before the Membranes ruptured.

Note the complete obliteration of the cervix. (Braun.)

[*To face p.* 271.

the lower segment; it would be a misfortune if it was to do so. With this view, as also with the opinion that the head does not plug the lower segment under normal circumstances, we cannot agree. Clinically, it is a matter of common experience that if any factor prevents the descent of the presenting part into the lower segment, or if the presenting part is not of such a shape that it can plug the lower segment, the membranes protrude through the cervix in a conical tumour, in some cases to such an extent as to fill the entire vagina, and their early rupture is the rule. Further, in normal cases the increase in the quantity of liquor amnii in front of the presenting head during a contraction is not so great as would be the case if free communication existed between the fore- and hind-waters.

(4) *Diminution in the Size of the Upper Uterine Segment.*—As we have already seen, contraction of the uterine muscle during labour results in a temporary diminution in size of the upper segment and the consequent expulsion of the fœtus, while retraction results in a permanent and progressive diminution, and the consequent adaptation of the uterus to its lessened contents. Accordingly, during the first and second stage, the uterine cavity becomes smaller as the fœtus is expelled, and its walls at the same time increase in thickness; during the third stage, the cavity is only sufficiently large to contain the placenta; while, subsequent to the expulsion of the latter, the cavity is only a potential one. The thickness of the uterine wall at the commencement of labour, as ascertained from frozen sections, is about 7 millimetres (¼ inch). At the end of the second stage, it is found to be from 9 to 18 millimetres (⅜ to ¾ inch). The effect of this diminution in the size of the uterine cavity on the placenta will be subsequently discussed. Its effect on the uterine vessels is obvious. During the period of a contraction the uterine vessels are temporarily compressed and twisted, and as a result of retraction their permanent obliteration is procured. By this means, the hæmorrhage which would otherwise result from the opening of large vessels is prevented, the vessels being controlled, as it were, 'by thousands of living ligatures' (Pinard). During the process of detachment of the placenta, however—that is, before retraction is complete—a certain loss of blood normally occurs. The average amount is said to be four ounces before the expulsion of the placenta, and six ounces with the placenta and membranes (Dakin).

The Effect of the Uterine Contractions on the Pelvic Contents.—The manner in which the pelvic cavity is temporarily emptied of its contents in order to afford room for the passage through it of the fœtal head constitutes one of the most interesting phenomena of labour. If we contrast a sagittal section of the pelvis in the non-impregnated female with Braun's section of a patient who died during the second stage, we shall see what a complete clearance of the normal pelvic contents takes place. The contents of the pelvis, as ~~seen in anteroposterior section~~, are so arranged as to form two triangles separated from one another by the vaginal slit—an anterior and superior triangle, and a posterior and inferior triangle. The anterior triangle has its base on a line drawn through the pubis, and continued to the anterior commissure of the vagina, and its apex at the anterior lip of the cervix. The posterior triangle has its base on the last three pieces of the sacrum and on the coccyx, and its apex at the posterior commissure of the vagina. The structures contained in the anterior triangle are intimately connected with the cervical tissues, while the structures contained in the posterior triangle are quite independent of any uterine connections. To these relationships are due the disposition of the pelvic contents during labour. As the cervix is drawn upwards by the contraction of the longitudinal bands of muscle fibre, it draws up with it the greater part of the structures in the anterior triangle. In this manner, the bladder, which at the commencement of labour lay, while empty, entirely below the pelvic brim, ~~is drawn up out of the pelvis~~ into the abdomen. The ~~structures in the anterior triangle~~, which are not connected with the cervix—viz., the lower third of the vaginal wall and the urethra—are pushed ~~downwards in~~ front of the

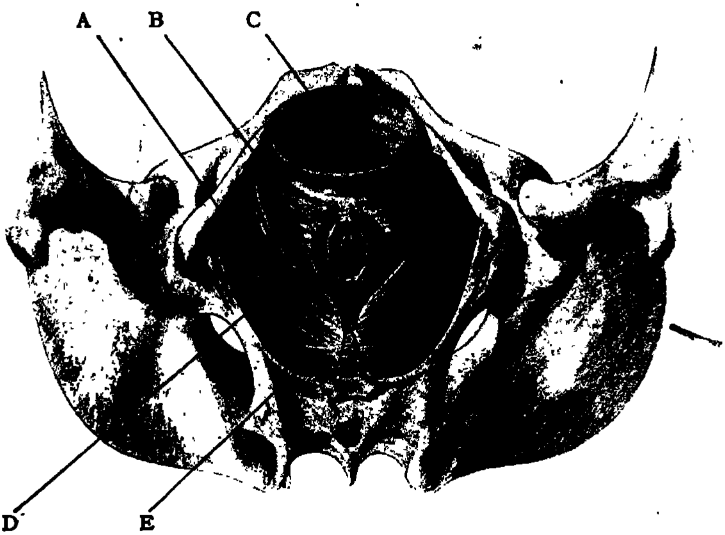

FIG. 153.—THE MUSCLES OF THE PELVIC FLOOR, SHOWN AT THE MOMENT OF COMPLETE DILATATION BY THE FŒTAL HEAD.

A, Pubo-coccygeus; D, obturato-coccygeus; E, ischio-coccygeus (A, D, and E are placed on the different parts of the levator ani muscle); B, sphincter ani; C, vagina. (Bumm.)

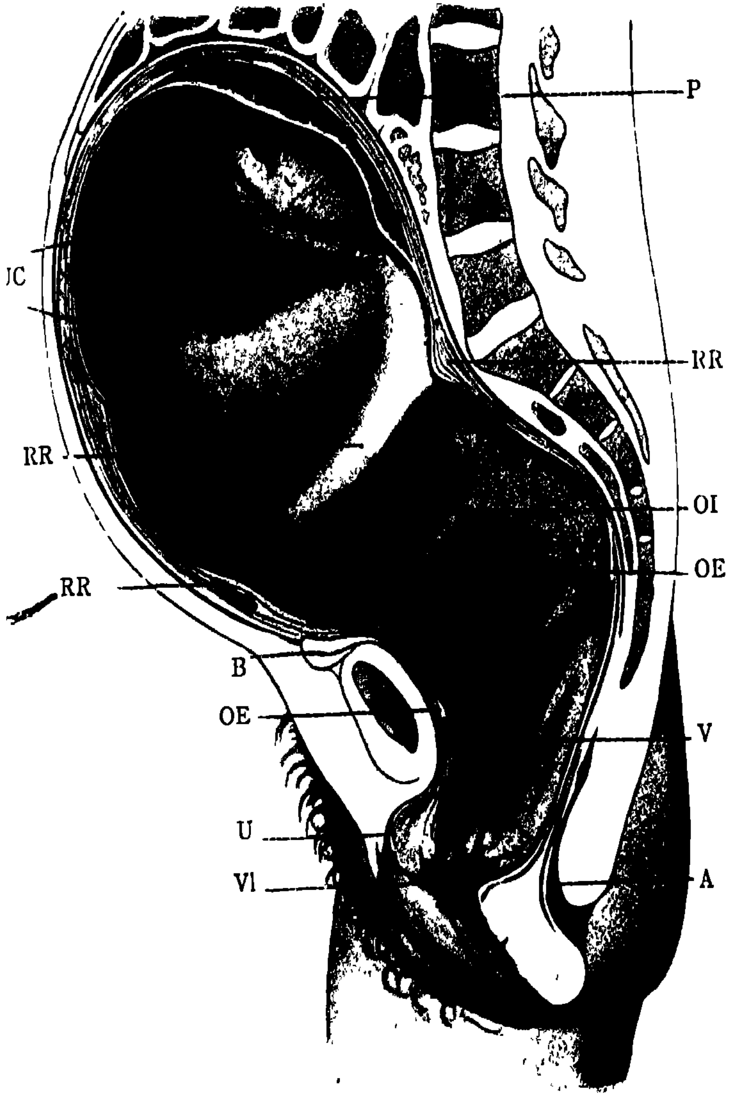

PLATE IV.—BRAUN'S SECTION, AFTER THE REMOVAL OF THE FŒTUS.

P, Placenta; UC, uterine cavity; RR, retraction ring; OI, os internum; OE, os externum; V, vagina; B, bladder; U, urethra; Vl, vulva; A, anus.

[*To face p.* 272.

presenting part. As the presenting part descends, it pushes before it the posterior triangle, which, as we have mentioned, is unaffected by the retraction of the cervix. In this manner, the lower portion of the rectum, the perinæal body, and the muscles of the pelvic floor, which lie posterior to the vagina, are pushed downwards by the presenting part (*v.* Figs. 152, 153). The displacement of these two triangles may be described, with Galabin, as resembling the opening of double doors which swing in opposite directions. As a result, the pelvis is practically empty save for the intermediate portion of the urethra, the rectum, and the vaginal mucous membrane, and so ample room is afforded for dilatation of the vagina during the passage of the presenting part (*v.* Fig. 154).

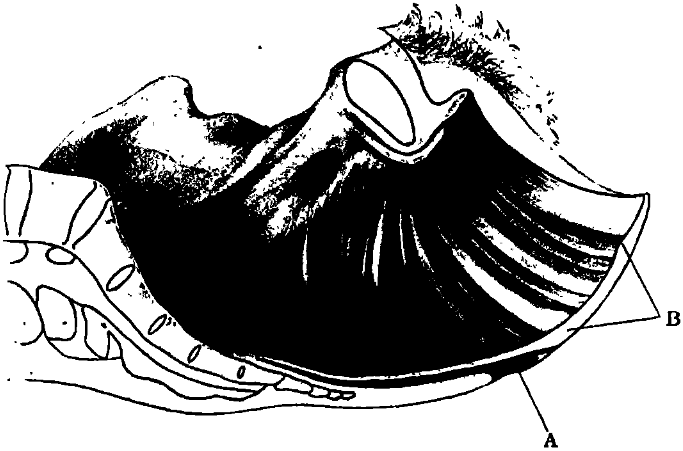

FIG. 154.—THE GENITAL CANAL IN A CONDITION OF COMPLETE DILATATION, AS SEEN AFTER MESIAL SAGITTAL SECTION.

A, Anus; B, perinæum. (Bumm.)

As the presenting part descends, it offers an obstruction to the return flow of blood in the veins, and the consequent rise in intravenous pressure, aided by the natural hyperæmic condition of the vaginal mucous membrane, causes a serous transudation from the vessels into the peri-vaginal and perinæal tissues and on the surface of the vaginal mucous membrane. The effect of this transudation is to render the tissues more distensile and so capable of dilatating to the necessary extent without laceration occurring, and, by increasing the amount of vaginal discharge, to reduce the friction between the vaginal mucous membrane and the skin of the fœtus to a minimum.

The Effect of the Uterine Contractions on the Perinæum and Neighbouring Structures.—When the presenting part reaches the pelvic floor, it lies on the levator ani muscle, supported in turn by the perinæum. As each contraction occurs, it is driven downwards a little and, in its descent, forces downwards and forwards both of these structures. Then, as the contraction passes off, the presenting part again recedes, forced upwards by the resisting levator ani muscle. This procedure recurs several times, each time the presenting part coming a little lower than the time before, but each time slipping back again into its former position. Finally, however, a contraction comes of sufficient strength to drive the presenting part between the lateral parts of the muscle in such a manner that the latter grips the part above its greatest convexity, and, consequently, is enabled to hold it in this position. As soon as this occurs, the head no longer recedes, but remains in the position into which it was driven by the contraction. The next contraction then is able to drive it out, and during this process the maximum distension of the perinæum occurs. The extent to which the perinæum is distended and displaced forwards and downwards can be easily understood from its relative measurements before and during the expulsion of the presenting part. The usual antero-posterior measurement of the normal unruptured perinæum prior to delivery is about one and a half inches, while at the time of maximum distension it measures from three to four inches, or even more. At the same time, there is a downward displacement of the anus and a curious alteration in its shape. The anterior margin of the anal orifice is drawn forwards with the perinæum and forms almost a straight line, while the convexity of the posterior edge is increased, probably due to its fixation by the attachment of the sphincter muscle to the tip of the coccyx. At the same time, there is an eversion of the rectal mucous membrane. The result is that the anal orifice assumes the form of a large capital D (Hart*), the straight stroke of the letter towards the vagina, its antero-posterior diameter almost an inch in length, and its transverse diameter slightly more. As the head passes through the vulva the so-called 'inevitable laceration of labour' occurs in the case of primiparæ, that is, the tearing of the posterior commissure of the vagina.

The Effect of the Uterine Contractions on the Pelvic Joints and Ligaments.—As already stated, all the cellular and connective tissue of the pelvis becomes softened, œdematous, and hypertrophied during pregnancy. The various pelvic ligaments undergo a similar change, especially just prior to parturition. These changes enable an increased amount of movement to take place at the various joints, and the mobility of the sacrum especially is increased. The pressure of the fœtal head when passing the brim is thus enabled to drive the base of the sacrum backwards, increasing thereby the conjugate diameter of the brim and diminishing that of the outlet. Later, when the head has descended further, the lower portion of the bone, no longer.

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* 'Selected Papers,' p. 141.

restrained by the softened sciatic ligaments, is driven upwards and backwards, and the outlet is widened, while at the same time the promontory is caused to project more prominently forwards. It is probable even that, owing to the great softening of the ligaments that occurs from the outflow of serous fluid into them, the sacrum to a very small extent may be driven bodily backwards, and by its wedge-shaped form may cause an increased separation of the ossa innominata, and a consequent slight augmentation of the transverse diameter. Even greater relaxation occurs at the symphysis pubis, and sometimes at the end of pregnancy the pubic bones may be made to move upon one another at this articulation. During labour, the bones become slightly separated, and thus increase the size of the pelvic inlet. Failure to return to the normal state sometimes gives rise to trouble after the puerperium.

The Effect of the Uterine Contractions on the Ovum.—As has been seen, the first effect of the uterine contractions on the ovum is to cause the latter to bulge in the direction of least resistance. As at the same time, the lower uterine segment is drawn upwards over the ovum, a slip, *i.e.*, a motion in opposite directions, takes place between the membranes forming the lower pole of the ovum and the lower uterine segment. This results in a detachment, to a greater or less extent, of these membranes from the underlying decidua, a process which is accompanied by slight bleeding. This blood, mingled with the mucous fluid which comes from the cervical glands, produces the so-called 'show' which usually ushers in labour. Another result of this detachment of the membranes is the production of the so-called 'bag of membranes,' the term applied to that part of the membranes which are felt protruding through the uterine orifice during labour. No further change takes place in the ovum until the dilatation of the cervix is complete. Then, in consequence of the loss of support which the undilated portion of the cervix previously furnished, the membranes rupture, and the liquor amnii, which constitutes the fore-waters, escapes. The manner in which premature rupture of the membranes is prevented has been already explained. As a rule, both chorion and amnion rupture simultaneously, and the site of rupture is anywhere in the unprotected area. In some cases, however, the amnion may rupture first, either over the area of detachment, or, more commonly, higher up in the uterus, and in this way fluid may find its way between the membranes, constituting an amnio-chorionic pouch. Such a pouch may also be produced by transudation of liquor amnii through the amnion, which has been shown to be the more permeable of the two membranes (Pinard). The rupture of a pouch formed in the latter manner, either before or during labour, has frequently been mistaken for the rupture of the membranes. The condition is known as amniotic hydrorrhœa.

In rare cases, the amnion or, more rarely still, both membranes, may persist unruptured even until after the birth of the head, when they usually tear across round the neck of the fœtus. Sometimes, they may instead tear away from the placenta and the child be born entirely enveloped in the membranes, or in very rare cases the entire ovum may be expelled intact. The latter are, however, only likely to occur in the case of a small ovum, and are relatively common in the case of miscarriages. As is well known, the term 'caul' is applied to the investing membrane by the public, and to it superstition has attached various properties, the most notable of which is that of saving the owner of such a possession from death by drowning. An infant who is born in a 'caul' is also credited with the prospect of a most fortunate future.

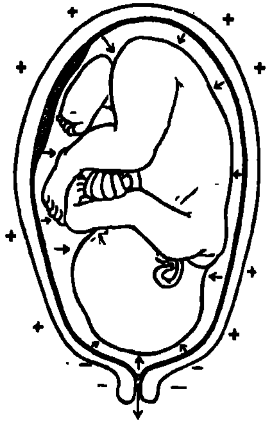

FIG. 155.—DIAGRAM REPRESENTING EFFECT OF GENERAL CONTENTS PRESSURE PRIOR TO RUPTURE OF MEMBRANES.

+, Area of uterine contractions; –, area of uterine relaxation.

The manner in which the force of the uterine contractions is transmitted to the fœtus varies according to the relation of the fœtus to the investing uterus. The contractions of the uterine muscle result in an increase in the intra-uterine pressure, and hence in the creation of a force which is termed variously the '*general intra-uterine pressure*' or the '*general contents pressure.*' If the fœtus is floating in the liquor amnii, the membranes being unruptured and the presenting part still unfixed, this force acts as a general and uniform pressure over all parts of the fœtus, and, consequently, does not tend to alter the position of the latter (*v.* Fig. 155). If, however, the presenting part is fixed in the pelvis, and is of such a nature that it can completely fill the lower uterine segment, then, as has been described, the contraction of the longitudinal bands of muscle fibres draw the lower segment upwards until there is a girdle of contact all round between it and the presenting head. As soon as this occurs, the hind-waters are shut off from the fore-waters and the 'general intra-uterine pressure' is only transmitted to the fœtal body and such part of the head as is above this girdle of contact. The result is that a force equal to the general intra-uterine pressure acts on the part of the head which is above the girdle of contact, and tends to drive it downwards (*v.* Fig. 156). This force, be it noted, acts uniformly over the basal area of the head, and, consequently, does not tend to alter the relation of the latter to the body, but solely to drive the head directly downwards. When, however, the liquor amnii has in part escaped and the uterine wall is in contact with the fœtal body, direct uterine pressure on the body results, and another force, which from its tendency to restore the uterus to its original form is known as '*form-restitution force*,' comes into play. The circular fibres of the uterus contracting strongly, cause, as we know, a diminution in the transverse and antero-posterior diameters, and so exert a lateral pressure upon the fœtus. This pressure tends to straighten the fœtal body and brings about an actual increase in length of about 1¼ inches.* This brings the fundal pole of the fœtus into contact with the fundus of the uterus, with the result that the contractions of the longitudinal bundles of muscle fibre cause a force which acts directly downwards on the fundal pole. The resultant of these two forces—the circular force which straightens the fœtal body, and the downward force which acts on its fundal pole—is a force termed '*fœtal axis pressure*,' which acts directly down the body of the fœtus and is transmitted to the head through the spinal column (*v.* Fig. 157). This force, there-

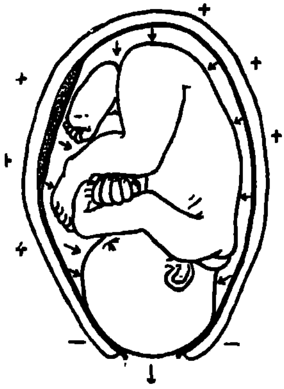

FIG. 156.—DIAGRAM REPRESENTING EFFECT OF GENERAL CONTENTS PRESSURE AFTER RUPTURE OF MEMBRANES.

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* Schaeffer, 'Obstetric Diagnosis and Treatment,' p. 68, American edition.

fore, does not act uniformly over the base of the head, and consequently is capable of producing a change in the relation between the head and the trunk.

To sum up, the forces which act on the fœtus are two in number:—

(1) The general intra-uterine pressure, acting uniformly, at first over the entire fœtus and subsequently over such part of the fœtus as is above the girdle of contact of the lower uterine segment. It is the most important force, and is present during the whole of labour save in the rare cases in which the entire liquor amnii has escaped.

(2) The form-restitution force, due to the tendency of the uterus to return to its normal shape, acting on whatever parts of the fœtus come into direct contact with the uterine wall after rupture of the membranes. As soon as this occurs, it results in the production of a single force acting downwards along the axis of the fœtus —fœtal axis pressure.

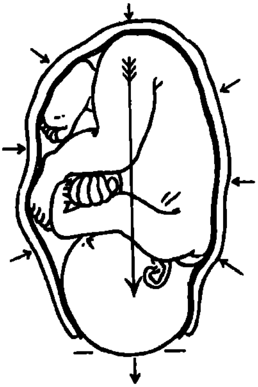

FIG. 157.—DIAGRAM REPRESENTING 'FŒTAL-AXIS PRESSURE.'

As soon as the membranes have ruptured, the contractions of the uterus drive the fœtus downwards into the vagina, and finally expel it complete. The remainder of the liquor amnii accompanies and follows the birth of the fœtus. The various alterations in the position and the attitude of the fœtus which occur during this process are termed the mechanism of labour, and as they differ according to the presentation of the fœtus, they will be discussed in the chapters on the various presentations.

In addition to these alterations, changes take place in the shape of the fœtal head as a result of the pressure it undergoes in its passage through the pelvis. These changes are known as the moulding of the head, and result in a diminution of those diameters which are most compressed with a compensatory elongation of those which are not compressed. As has been already shown, the moulding of the head is rendered possible by the presence of the sutures and fontanelles. The precise nature of the changes which occur differs according to the presentation, and will be referred to in its proper place. Speaking generally, however, it may be said that, as a rule, one parietal bone slides under another, the frontal bone slides under the parietal bones, and the occipital bone does the same. The cartilage between the squamous and temporal portions of the petrous bone acts as a hinge, and so allows the former portion to be pressed inwards.

Another change which takes place is the formation of the '*caput succedaneum*,' the term applied to the sero-sanguineous swelling which forms on the unprotected area of the presenting part – *i.e.*, the area corresponding to the uterine orifice—in consequence of the pressure to which the remainder of the body is subjected. The caput succedaneum is a tolerably firm swelling of doughy consistency, and which pits upon pressure. It is formed by a transudation of lymph from the vessels into the tissues of the scalp, with a little added blood due to minute hæmorrhages, the result of the laceration of small vessels (*v.* Fig. 158). Its size depends upon the duration of labour and the strength of the uterine contractions. The site of the caput of necessity varies according to the nature of the presentation and the position of the fœtus, and its exact site also changes during labour according as the presenting part flexes, extends, and rotates. This will be again referred to. The caput succedaneum usually disappears completely in from twenty-four to forty-eight hours after birth. In cases in which it forms on the face, marked temporary disfigurement often results owing to

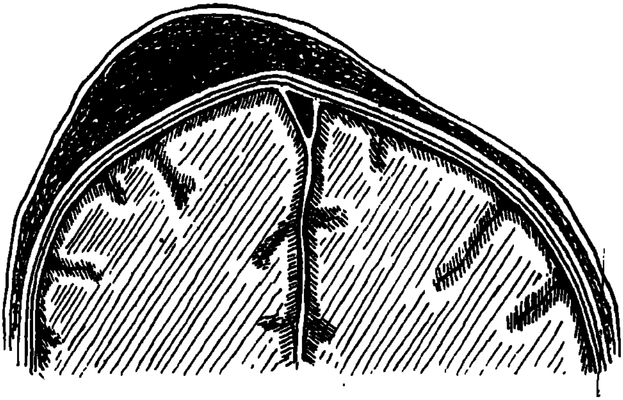

FIG 158.—CORONAL SECTION THROUGH FŒTAL HEAD AT THE SITE OF THE CAPUT SUCCEDANEUM. (After Ribemont-Dessaignes.)

distortion of the features, and may cause the parents considerable anxiety. It is, however, only temporary.

The contractions of the uterus return a short time after the birth of the fœtus, and bring about the detachment of the placenta and the decidua and their expulsion. The exact nature of the mechanism by which these processes are effected cannot be regarded as completely ascertained. The most obvious and commonly accepted theory is that of Schultze.* He considered that the placenta was first detached in consequence of a 'slip' of the uterine wall on it, consequent on the shrinkage which occurs in the placental site as the uterus contracts down after the birth of the fœtus; that blood escaped from the uterine vessels into the retro-placental space thus formed, completed the detachment, and at the same time drove the placenta downwards into the membranes with its fœtal surface lying lowest; and that the contractions of the uterus, acting on this hæmatoma, completed the expulsion of the placenta from the upper segment of the uterus (*v.* Figs. 159, 160). Matthews Duncan,† on the other hand

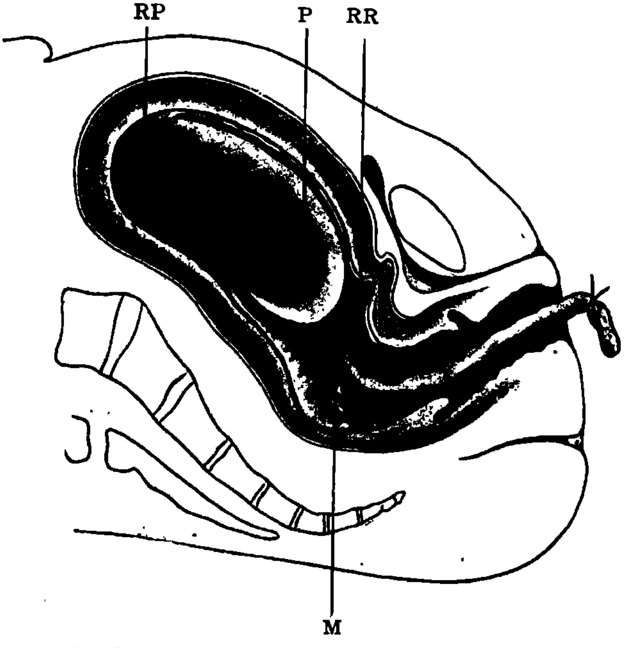

FIG. 159.—THE SEPARATION OF THE PLACENTA: SCHULTZE'S MECHANISM. RP, Retro-placental clot; P, placenta; RR, retraction ring; M, membranes.

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* 'Nachgeburtslösung,' *Deutsche Med. Wochen.*, 1880, Nos. 51, 52.

† *Edinburgh Obstet. Trans.*, vol. ii., 331.

considered that the placenta, after its detachment, was expelled from the uterus with its lower border first, and that it passed through the retraction ring as a button passes through a buttonhole (*v.* Figs. 161, 162). The Edinburgh School, in the persons of Hart and Barbour, brings forward two theories, as to the cause of placental separation and expulsion, which differ from the foregoing. Barbour* considers that he has proved that the placental site can be reduced to a space of 4½ by 4 inches without causing detachment of the placenta. He also considers

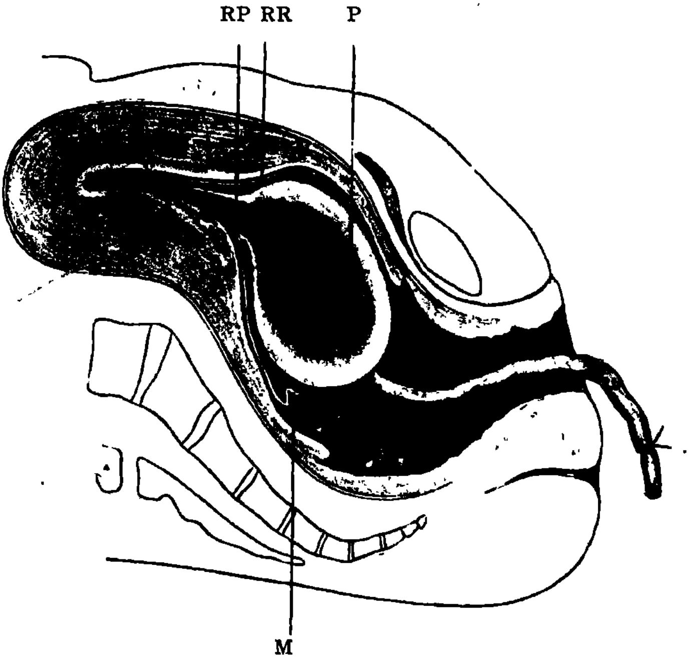

FIG. 160.—THE EXPULSION OF THE PLACENTA FROM THE UTERUS: SCHULTZE'S MECHANISM.

RP, Retro-placental clot; P, placenta; RR, retraction ring; M, membranes.

that if the uterus contracts firmly down upon the placenta it will tend to expel the latter, and that during this process separation will naturally occur. Accordingly, he attributes the separation of the placenta to the diminution of the placental site to an area of less than 4 by 4½ inches, plus the action of the uterus, as a whole, on the placental mass. Hart, on the other hand, while agreeing that the main cause of the separation of the placenta is to be found in disproportion between its area and the area of the placental site, considers that the cause of the disproportion is, not the placental site becoming smaller than the placental area, but its becoming larger than the latter. His reasons for this belief are as follows :—So long as the placenta has either or both its blood-supplies from the maternal or fœtal vessels intact, it can diminish or increase in size *pari passu* with the portion of uterine wall to which it is attached. When, however, the supply from both fœtus and mother is cut off, the placenta can diminish *pari passu* with the uterine wall, but cannot again expand as the wall relaxes. Consequently, separation occurs during the relaxations of the uterus, which occur after the fœtal circulation has ceased owing to the ligation of the cord or other cause, and after the maternal supply has been cut off by the retraction of the uterus.

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* *Edin. Med. Journ.*, p. 301, October, 1895.

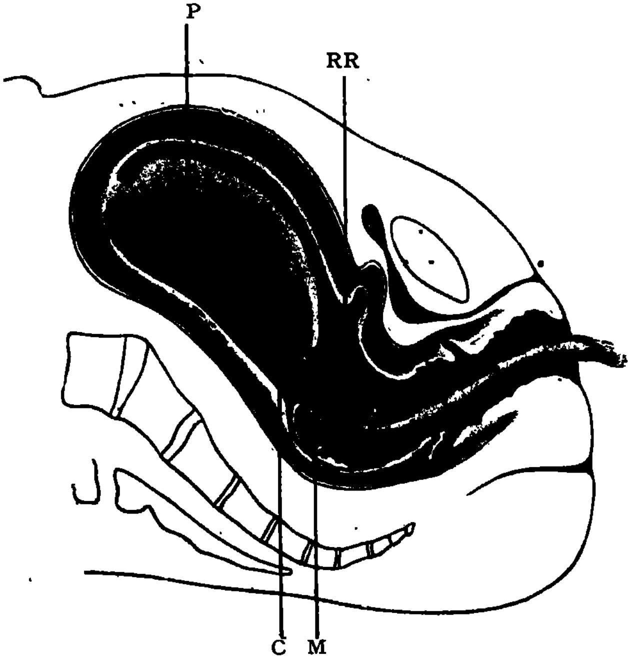

FIG. 161.—THE SEPARATION OF THE PLACENTA: MATTHEWS DUNCAN'S MECHANISM.

P, Placenta; RR, retraction ring; C, blood-clot; M, membranes.

To us, Schultze's theory appears the most obvious and the most natural, save in cases in which the placenta extends almost or quite into the lower uterine segment. In such cases, a hæmatoma does not in all probability form, or if it does the accumulated blood escapes before it is sufficient in amount to influence the attachments or position of the placenta, and the placenta is probably wholly detached by a slip of the uterine wall upon it. It is probable that, in these cases, Matthews Duncan's mechanism of expulsion occurs.

The following figures (Pinard and Lepage*), the result of 7,682 normal confinements, show the very much greater frequency with which the placenta is expelled with its fœtal surface presenting:—

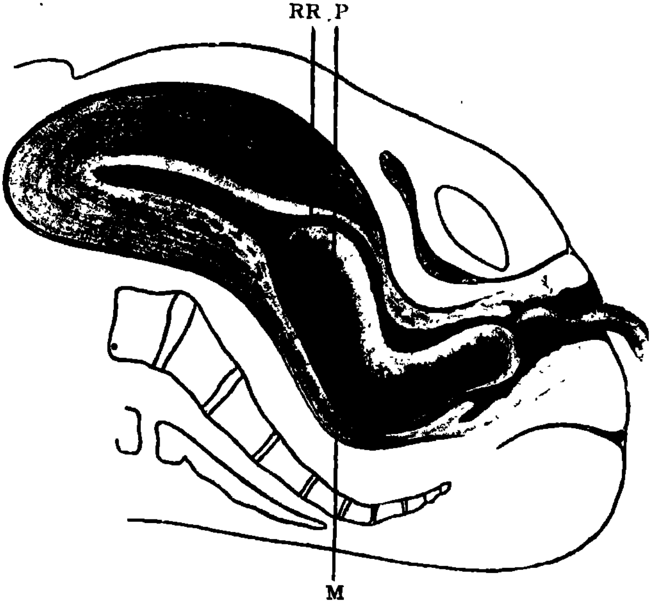

FIG. 162.—THE EXPULSION OF THE PLACENTA FROM THE UTERUS: MATTHEWS DUNCAN'S MECHANISM.

P, Placenta; RR, retraction ring; M, membranes.

The fœtal surface presented in -	6,206 cases, or 80·79 per cent.
The edge presented in - - -	1,077 cases, or 13·4 per cent.
The uterine surface presented in -	399 cases, or 5·66 per cent.

When the placenta has been expelled from the upper uterine segment it lies in the lower segment, from which it is, as a rule, expelled artificially. If its expulsion is left to the natural efforts, it takes place sometimes within a comparatively short time as a result of strong bearing-down efforts on the part of the patient, united with the contractions of the vaginal muscles. More frequently, however, the process is much more prolonged, and is only completed after several hours. The apparent failure of nature to effect the expulsion of the placenta from the vagina is mainly the result of the artificial surroundings and position of the patient. In savage races, even at the present time, where the mother is confined *more ferorum*, the placenta is usually expelled by the natural efforts, and most commonly by an effort in the squatting position, as in defæcation. In civilized races, on the other hand, the acquired necessity for remaining in the recumbent position prevents the exertion of a sufficient degree of force, and consequently artificial aid is required.

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* Ribemont-Dessaignes and Lepage, 'Précis d'Obstétrique,' vol. i., p. 504.

9 **The Effects of the Uterine Contractions on the Maternal System.**—During a contraction of the uterus, the heart-rate of the mother is progressively increased as the contraction rises to its acme, when it attains ~~a rate~~ of twelve ~~or more beats per~~ minute (Winckel) in excess of its previous rate. This again gradually falls as the contraction passes off, until the former rate is regained in the interval between the contractions. This contrasts with the effect of the contractions upon the fœtal heart-rate. In the latter, the ~~rate gradually~~ falls, ~~until~~ it ~~reaches~~ a minimum at the acme of the contraction, and then again increases as the contraction passes off. The slowing which occurs during a pain may be as much as 10 or 12 beats in ten seconds, or at the rate of from 60 to 72 per minute (Kehrer and Ziegenspeck*). That is to say, during a contraction the fœtal heart-rate falls from an average rate of 140 per minute to an average of from 80 to 68. This slowing is somewhat more marked towards the end of the first stage and in the second stage. It is usually explained as due to one of the following causes:—

(1) Increased pressure on the surface of the fœtus, causing increased peripheral resistance in the bloodvessels and slowing of the heart, in accordance with the observation made by Marey that the frequency of the heart is in inverse proportion to the peripheral resistance.

(2) Compression of the fœtal head, causing irritation of the vagus. This would account for the fact that the diminution in rate at the acme of the contraction is more marked in the second stage than in the first stage.

(3) Interference with the placental circulation, and a corresponding degree of asphyxia.

The respiratory rate of the mother is somewhat more frequent during labour than it is during pregnancy (20·7 per minute in labour to 18·7 in pregnancy—Winckel), and falls during a contraction to an extent equal to a difference in rate of about 6·8 per minute (Winckel). In some cases, a more marked increase occurs during labour. The maternal temperature is said to rise during a contraction from 0·36 to 0·93 of a degree Fahrenheit.

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* Kehrer, 'Vergleich. Phys. der Geburt. des Menschen und der Säugethiere,' S. 41. Ziegenspeck, 'Einfluss der Wehe auf die Herzthätigkeit des Kindes,' I. D., Jena, 1885.

CHAPTER II

THE STAGES AND PROGNOSIS OF LABOUR

The Duration of Labour—The Stages of Labour; The Premonitory Stage, Phenomena; Diagnosis; The First Stage, Duration, Phenomena, Clinical Events, Diagnosis; The Second Stage, Duration, Phenomena, Clinical Events, Diagnosis; The Third Stage, Duration, Phenomena, Clinical Events, Diagnosis—The Symptoms of Prolonged Labour—The Prognosis of Labour; The Statistics of the Rotunda Hospital and of the Registrars-General for England and Ireland.

In this chapter, we propose to discuss the phenomena of the stages of labour from a more clinical standpoint than that which was adopted in the previous chapter. A few repetitions may occur in its course, but these will only be made where they are calculated to assist the student.

Duration.—The duration of labour varies very greatly in different women, and depends to a considerable extent upon the lie, presentation, and size of the fœtus, the capacity of the genital passages, and the strength of the uterine contractions. If the fœtus is of normal size and presents by the vertex, if the pelvis and genital passages are of their normal capacity, and if the uterine contractions are of their normal strength, the average duration of labour is in primiparæ from twelve to fourteen hours, in multiparæ from six to eight hours. The following figures show more accurately the relative duration of labour in primiparæ and multiparæ under normal circumstances.* The figures relating to primiparæ are based on the results of 3,403 cases, those relating to multiparæ on 4,130 cases:—

Duration of Labour.	Primiparæ (3,403 Cases).	Multiparæ (4,130 Cases).
Less than 6 hours - -	15 per cent.	42 per cent
From 6 to 12 hours - -	40 ,,	40 ,,
,, 12 to 18 ,, - -	29 ,,	11 ,,
,, 18 to 24 ,, - -	9 ,,	5 ,,
More than 24 ,, - -	7 ,,	2 ,,

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* Pinard and Lepage at the Clinique Baudelocque, 1891, 1895.

THE STAGES OF LABOUR

The process of labour is divided into three stages:—The first stage, or stage of dilatation; the second stage, or stage of expulsion; and the third stage, or the placental stage. In addition to these three stages, it is convenient to recognise an additional stage—the premonitory stage—inasmuch as labour is ushered in by a definite train of symptoms and physical signs.

THE PREMONITORY STAGE.

The premonitory stage is most irregular, both in the time of its onset and in the degree to which its symptoms occur. As a rule, the latter first show themselves a day or two before labour, properly so called, commences. In primiparæ the symptoms are well marked, in multiparæ they may be slight or altogether absent.

Phenomena.—The principal phenomena of the premonitory stage are as follows:—

(1) The Occurrence of False Pains.—The commonest phenomenon of commencing labour is the occurrence of irregular pains which have no definite seat, but are felt generally over the abdomen. These pains, which may be considered as intermediaries between the painless contractions of pregnancy and true labour pains, are known as *false pains*, or *dolores presagientes.* They occur at widely separated intervals, and are distinguished from true labour pains by their irregularity, and by the fact that they are not referred to the back.

(2) Partial Dilatation of the Cervical Canal, and Increased Softening of the Cervix.—The changes which occur in the cervix during this stage differ in primiparæ and multiparæ. In primiparæ, there is, as a rule, no dilatation of either the internal or the external os until labour has actually commenced, and the changes characteristic of this stage are limited to increased softening, due to hyperæmia of the cervical tissues. In multiparæ, on the other hand, the external os usually commences to dilate some days before the onset of labour, so that the finger may be passed a short way into the cervical canal. In both primiparæ and multiparæ, the operculum or plug of mucus which fills the cervical canal is expelled.

(3) The Onset of the 'Show.'—The show is the term applied to a blood-stained mucous discharge which escapes from the cervix during the premonitory stage. It is composed mainly of cervical mucus, with the addition of a small amount of blood—the result of commencing detachment of the membranes in the neighbourhood of the internal os.

(4) Swelling of the Vulva.—A slight degree of swelling of the vulva very constantly occurs. It is due to the increased obstruction offered to the return of blood owing to the pressure exerted

upon the veins by the descending head, and also to hyperæmia of the vessels.

To this list the falling of the fundus of the uterus to a lower level in the abdomen and the fixation of the fœtal head are very frequently added. At the end of the thirty-sixth week, the fundus has reached the level of the ensiform cartilage, while at the commencement of labour it is found to be midway between the ensiform cartilage and the umbilicus. As, however, this change gradually occurs during the last three weeks of pregnancy, it can hardly be considered as one of the premonitory symptoms of labour. The fixation of the fœtal head is equally foreign to this stage. In primiparæ the head is, as a rule, fixed in the pelvis during the last few weeks of pregnancy, while in multiparæ it is free above the brim until labour has actually commenced. Consequently, in neither case can it be regarded as a premonitory symptom.

Diagnosis.—It is by no means easy to determine whether the patient has reached the premonitory stage of labour or not, and the question can only be answered by carefully looking for the various symptoms and physical signs which have been described. The occurrence of irregular pains is, however, sometimes deceptive, as they may be due to flatulence or other similar causes.

2 THE FIRST STAGE.

The first stage, or the stage of dilatation, commences with the onset of true uterine contractions and the accompanying dilatation of the internal os, and ends with the full dilatation of the os and the rupture of the membranes. It is the longest of the three stages of labour, and occupies on an average in primiparæ from eleven to twelve hours, and in multiparæ from five to seven hours.

Phenomena.—The principal phenomena of this stage are as follows:—

(1) **The Occurrence of Uterine Contractions.**—The occurrence of the true uterine contractions of labour is one of the principal phenomena of the first stage. They differ from the contractions which have previously occurred in that they are pain-causing contractions that they are rhythmical, and that the pain they cause is referred principally to the back.

(2) **The Taking-up and Dilatation of the Cervix.**—As a result of the occurrence of contractions, the taking-up of the cervical canal commences. This process has been already fully described, and need not be again referred to. As soon as it is complete, the uterine orifice dilates to the size necessary for the passage of the fœtus.

(3) **The Rupture of the Membranes.**—As soon as the uterine orifice is completely dilated, the membranes rupture as a result

of the loss of the support which they previously received from the cervical walls.

(4) The Fixation of the Head.—If the head is not already fixed in the pelvis—as is the rule in primiparæ, it fixes shortly after the commencement of uterine contractions.

Clinical Events.—At the commencement of labour, the patient may pursue her ordinary occupations, save when a pain occurs. The latter at first are felt at intervals of half an hour or more, but as the stage advances they become more frequent, until towards the end they occur every two or three minutes. The pain experienced by the patient is referred to the region of the sacrum. It is usually of a dull aching character, and may be so severe as to cause her to cry out. The pulse and temperature are, as a rule, unaffected, save for a slight increase in frequency in the former during a contraction. Gastric disturbances associated with vomiting are of common occurrence, particularly towards the end of the stage.

Diagnosis.—It is an easy matter to determine the onset of labour in the case of a patient in whom contractions are occurring forcibly and regularly. It is, however, a most difficult matter to be certain whether labour has commenced or not when we see a patient a little before or a little after the commencement of the stage, as all the symptoms of the premonitory stage are present during the first stage save the false pains, which, together with the painless contractions of the uterus, disappear, and are replaced by painful contractions. The latter can be recognised by laying the hand flat on the abdomen, and determining the fact that the occurrence of pain is preceded and accompanied by an easily perceptible hardening of the uterus. They are a sure sign that labour has commenced. Further, if the fœtal head, which a previous examination showed to be above the pelvic brim, is now found to be fixed, we know labour has commenced. The most reliable sign furnished by vaginal examination—indeed, perhaps the earliest sign of the onset of labour—consists in the commencing dilatation of the internal os. This is ascertained by passing the finger into the cervical canal, when the presenting part, or the membranes, will be felt instead of the ring of cervical tissue which formerly barred the further progress of the finger, and at the same time it will be noted that an actual shortening of the cervix has taken place. If, during a contraction, there is a further dilatation of the internal os, as shown by the fact that the membranes bulge through it to an increasing extent, we have a definite sign that labour has started.

THE SECOND STAGE.

The second stage, or stage of expulsion, commences with the full dilatation of the os and the rupture of the membranes, and ends with the expulsion of the child. Its average duration is from one to two hours in primiparæ, and from ten to fifteen minutes in multiparæ. It varies considerably in individual cases; as is shown by the following table, which has been compiled from the results ascertained in the case of 3,428 primiparæ and 4,099 multiparæ.* In every case the maternal passages were normal, and the child was delivered alive.

Duration of Second Stage.	Primiparæ (3,428 Cases).	Multiparæ (4,099 Cases).
Less than 15 minutes -	22 per cent.	69 per cent.
From 15 to 30 „ - -	21 „	17 „
„ 30 to 60 „ - -	26 „	9 „
„ 60 to 120 „ - -	21 „	4 „
Above 120 minutes - -	10 „	1 „

It is usually considered that in the case of elderly or very young primiparæ the process of labour is considerably longer than in the case of primiparæ between twenty and thirty. That this was so was denied so long ago as the time of Madame Lachapelle,† and her statements have been recently supported by the statistics which have been personally collected by Dubé,‡ who gives the following averages :—

Primiparæ below 20 (378 cases) -	Total duration of labour - - - „ „ second stage - -	13 hours 5 mins. 1 hour 15 „
Primiparæ between 20 and 30 (378 cases) -	Total duration of labour - - - „ „ second stage - -	13 hours 28 mins. 0 „ 59 „
Primiparæ over 30 (378 cases) -	Total duration of labour - - - „ „ second stage - -	13 hours 19 mins. 1 hour 10 „

These figures differ so considerably from what we conceive to be the general opinion held on this question that they are worthy of attention.

Phenomena.—The chief phenomena of the second stage are the continuance of involuntary contraction and retraction of the uterine muscle, with the addition of the voluntary contractions of the accessory muscles of labour, and the consequent expulsion of the fœtus.

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* Pinard and Lepage.

† 'Pratique des Accouchements,' mémoire i., p. 59.

‡ Ribemont-Dessaignes and Lepage, 'Précis d'Obstétrique,' p. 344.

Clinical Events.—The nature of the uterine contractions remains unchanged, save that they become more violent and last for a longer time. The interval between them is also lessened. They vary in length from thirty to sixty seconds, and occur every five to seven minutes up to the actual time of expulsion, when they follow one another almost without a break. The voluntary contractions of the abdominal muscles impart to the second stage pains their expulsive character. As each contraction commences, the patient fixes her diaphragm by closing the glottis after a deep inspiration, and, contracting her abdominal muscles to the utmost, brings all the force she can to bear upon the uterus and its contents. The reason that these voluntary expulsive efforts do not occur during the first stage is obvious. At that time, the undilated cervix offers a bar to the advance of the uterine contents, and hence the effect of the contraction of the abdominal muscles is merely to drive the entire uterus downwards into the pelvis without in any way furthering the expulsion of the ovum. In the second stage, the cervical obstruction is removed, and the compression of the uterus by the voluntary contractions of the abdominal muscles materially assists in hastening the expulsion of the fœtus. Expulsion commences as soon as the membranes rupture, provided that event corresponds with the period of full dilatation of the uterine orifice. The presenting part is driven downwards through the vagina until it reaches the perinæum, where there is usually a little delay. As each fresh contraction occurs, the presenting part advances a little, and can be seen at the vulva separating the labia; and as the contraction passes off it again recedes into the vagina. Finally, it descends so far that it becomes gripped by the levator ani muscle, in consequence it does not recede, and then, in all probability, the next contraction will cause its expulsion. As the presenting part is passing over the perinæum, the pain caused is so severe that the patient is compelled to cry out. This act is of considerable practical importance, as by the opening of the glottis the voluntary bearing-down efforts are checked, the expulsion of the fœtus is slowed, and so a longer time is given to the perinæum to dilate.

The symptoms of the second stage are more marked than are those of the first, owing to the increased strength of the uterine contractions, and to the fact that the passage of the fœtus through the vagina increases the patient's suffering. The frequency of the pulse-rate and of respiration are slightly increased during a contraction, but are otherwise unaffected, and profuse sweating may occur. As the presenting part presses more and more upon the rectum the patient experiences a strong desire to go to stool, although there is usually nothing in the bowel to evacuate.

Diagnosis.—The diagnosis of the onset of the second stage can be made by noting the change in the character of the pains, and by ascertaining from the patient herself or her attendants whether the membranes have ruptured or not. If a vaginal examination is made, the condition of the cervical canal can be determined. The rate of advance of the presenting part through the pelvis can be best ascertained by abdominal palpation.

THE THIRD STAGE.

The third stage, or placental stage, commences as soon as the fœtus has been expelled, and ends with the delivery of the placenta and membranes. It is difficult to estimate its average duration, as the latter depends entirely upon the manner in which the stage is conducted. If the expulsion is left to the natural efforts, the average duration is said to be from one to three hours; but this estimate is probably too little.* If, however, the usual method is adopted of waiting until the placenta has been detached and expelled from the uterus by the uterine contractions, and of then expressing it by the Dublin method, the average duration of the stage is from ten to fifteen minutes.

Phenomena.—The principal phenomena of the third stage are the continuance of intermittent contractions and of permanent retraction of the uterine muscle, the detachment of the placenta, and the expulsion of the latter, first, from the contractile upper segment of the uterus into the lower segment or into the vagina, and then from the latter segment externally.

Clinical Events.—Clinically, it is most convenient to consider the third stage as composed of two periods, in accordance with the periods of placental expulsion to which we have just referred. In the first period, the placenta is detached, and is expelled below the retraction ring; in the second period, it is driven outside the genital passages. We shall see the importance of recognising these periods when we discuss the treatment of the third stage, as during the first period the expulsion of the placenta is left to the natural efforts, while during the second period its expulsion is hastened by active assistance.

Immediately after delivery the patient experiences a marked sense of relief, due to the almost complete cessation of pain.

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[*] The following table shows the results of 100 cases of labour in which the delivery of the placenta was left to nature (Kabierske, *Centralblatt für Gynäkol.*, 1881):—

Number of Cases.	Duration.	Number of Cases.	Duration.
24	30 mins.	5	5 hours
20	1 hour	3	6 ,,
25	2 hours	2	8 ,,
11	3 ,,	1	12 ,,
9	4 ,,		

Her temperature may be slightly higher than during labour, while the pulse-rate is usually somewhat less than it was at the end of the second stage. The subsequent condition of the patient entirely depends on the amount of blood which is lost. In some cases there may be a slight increase in the pulse-rate and a fall in the temperature of one or two degrees, owing to the amount of blood lost, and to the chilling of the patient which may occur during the delivery of the after-birth and the necessary cleansing of the parts. The pain caused by the uterine contractions during this stage is not, as a rule, very severe.

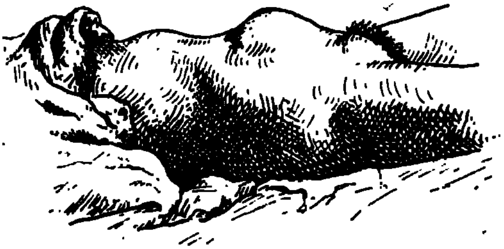

FIG. 163.—PROFILE OF THE ABDOMEN DURING THE THIRD STAGE. The placenta is still in the uterus. (After Varnier.)

Diagnosis.—The descent of the placenta below the contraction ring—*i.e.*, the commencement of the second period of the third stage—can be recognised by certain changes which take place. These are as follows:—

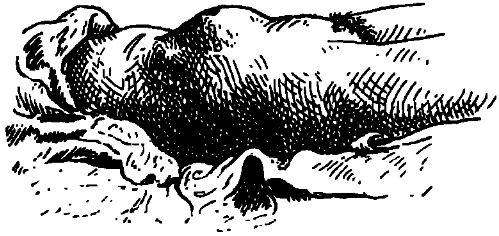

FIG. 164.—PROFILE OF THE ABDOMEN DURING THE THIRD STAGE. The placenta has left the uterus and is lying in the lower uterine segment. Note the forward bulging of the abdominal wall above the symphysis, due to the situation of the placenta, and the increased height of the uterus in the abdomen. (After Varnier.)

(1) The Funis Lengthens.—As the placenta leaves the uterus and comes to lie in the vagina the cord simultaneously descends, and consequently the extravaginal portion increases in length. This increase in length will be readily recognised if, when tying the cord, the ligature which is placed next the mother is tied as

close to the vulva as possible. It thus forms an indicator on the cord, and enables any elongation of the extravaginal portion to be readily detected. In order to guard against the error which might result from the expulsion of a loop which had been previously coiled up in the vagina, it is well, before tying the ligature, to draw gently on the cord, in order that any such loop may be straightened out.

(2) The Fundus of the Uterus Rises upwards to the Umbilicus. —After the expulsion of the fœtus the body of the uterus sinks downwards into the thinned-out lower uterine segment and the vagina under the pressure of the abdominal contents and the controlling hand of the obstetrician. As the placenta is expelled from above the contraction ring, it comes to lie in the lower segment, and pushes the upper segment upwards out of the pelvis. As a result the fundus, which at first lay only slightly above the pubis, rises until it reaches almost the level of the umbilicus.

(3) The Mobility of the Uterus is Increased.—This change also depends upon the alteration in the position of the body of the uterus. When the latter lay in the pelvic cavity, and still enclosed the placenta, it was more or less supported all round by the brim of the pelvis, and consequently could not be readily moved from side to side. As it rises out of the pelvis this support is lost, and consequently it becomes more mobile.

(4) The Abdominal Wall bulges Forwards above the Pubis.—This change is not, as a rule, as well marked as are the others we have mentioned. It occurs in some cases, and is due to the fact that the placenta lying in the lower uterine segment pushes forward the structures lying in front of it, and so causes a prominence above the pubis resembling a full bladder, for which it can easily be mistaken.

THE SYMPTOMS OF UNDULY PROLONGED LABOUR.—It is a matter of extreme practical importance to recognise the symptoms which show that the patient has been in labour as long as, or longer than, is safe. The first and most constant symptom is acceleration of the pulse-rate. This gradually rises from a rate of 70 to 80 beats per minute to one of 120 to 160. Occasionally, a patient may have a rapid pulse from the commencement of labour, and in such cases due allowance must be made for this. Another symptom which very commonly accompanies a rise in pulse-rate is elevation of the temperature. This, however, is by no means an invariable accompaniment, and in all probability does not directly depend upon the long continuance of labour. It is more likely to be due to the decomposition of lochia and blood in the vagina, and so to be the symptoms of a slight sapræmic infection. Indeed, it is probable that, but for such an infection, the temperature would fall in cases of undue prolongation of labour in consequence of the gradual diminution of the strength of the patient.

3 The appearance of the patient is also altered. Her face assumes a haggard aspect, is drawn and anxious, and expressive of the degree of suffering which she has gone through. Her skin becomes dry and hot, or at a later stage may be covered by a cold perspiration. The lips are dry, and sordes accumulate about them, while the tongue is also dry and brown.

4 The remainder of the symptoms are the result of the changes which are taking place in the uterus as a result of the long-continuance of contractions. a The character of the contractions is altered. In some cases, they temporarily cease, and return, perhaps, again in a short time, or they may die away altogether, when a condition of missed labour results. In other cases, they become more violent and painful, and after a time lose their intermittent character altogether and become continuous or tonic. In such cases the abdomen becomes tense and tender, and it is difficult or impossible to feel the fœtal parts. b The muscle fibre of the round ligaments shares in this tonic contraction, and the ligaments stand out on the surface of the uterus as tense cords, one or both of which can be readily palpated. c The most important change in the uterus is, however, that brought about by the retraction of the muscle fibres. In consequence of this, as has been already explained, the walls of the upper segment of the uterus grow thicker and the cavity becomes smaller the longer labour lasts, while the walls of the lower segment become thinner and its cavity larger. The junction between the two segments—*i.e.*, the retraction ring—in consequence occupies a progressively higher level in the abdomen. d Another result of retraction shows itself in the shortening of the longitudinal bands which run down into the cervix, and which, by drawing up the cervix, cause ballooning of the vault of the vagina. This change can, of course, only be noticed in cases in which the presenting part is still above the brim.

5 In addition to recognising the symptoms which show that the mother has been too long in labour, it is also a matter of importance to recognise the symptoms which show that the fœtus is suffering from the undue prolongation of labour. 1 As in the case of the mother, the earliest and most important sign of such a state of affairs is furnished by the rate of the heart. If the fœtal heart-rate commences to rise progressively in the intervals between the contractions of the uterus, or, on the other hand, to gradually fall, we have a certain sign that labour has lasted too long. Alterations in rate between 120 and 160 are of common occurrence, and are not important; but, once either of these limits is past, it shows that the fœtus is in distress. 2 Another sign is furnished by the coming away of meconium, unmixed with liquor amnii, in a head presentation. The fœtus, when in distress, as a rule passes meconium. If this comes away well mixed with the liquor amnii at the time of the rupture of the membranes, it shows that the fœtus was in distress some time previously, and

if the fœtal heart is at the time beating at a normal rate, that the cause of the distress has been removed. If, however, the meconium comes away during the second stage unmixed with liquor amnii, and, apparently, quite recently passed, it shows that the fœtus is in immediate distress. An exception to this must be made in the case of a pelvic presentation, when the coming away of meconium is of no importance, as it is the invariable result of pressure over the abdomen of the fœtus, associated with an absence of pressure over the anus. A third sign is furnished by tumultuous movements of the fœtus—a fact of which the patient will inform us, and which we can verify ourselves by placing the hand on the abdomen.

IV THE PROGNOSIS OF LABOUR

It cannot be too strongly insisted upon that, in normal labour, the rate of mortality for both mother and child should be nil. Labour is a physiological process, and, as such, has no more an inherent rate of mortality than has any other physiological process. To what, then, is the definite mortality rate which undoubtedly exists in childbed due? In other words, why does the mother or fœtus ever die during childbirth? The causes of maternal death may be grouped under three heads:—Purely obstetrical causes; pre-existing disease of the mother; and accidental causes.

Group I. Purely Obstetrical Causes of Death.—Labour can only be regarded as a physiological process so long as it occurs in a physiological manner. Once any deviation occurs from such a manner, then it becomes a pathological process, at least so far as that deviation is concerned. It is hard to define what exactly constitutes a physiological labour; but, at any rate, it is safe to say that any factor which interferes with the mechanical process of labour, or which tends to alter the course which labour normally follows, produces a pathological labour to a greater or less degree, and so tends to a similar degree to cause mortality. Thus, mal-presentations of the fœtus, rigidities or obstructions in the genital passages, detachments of the placenta prior to the expulsion of the fœtus, abnormalities in the fœtus or in the other constituents of the ovum, and such other causes as directly tend to make labour more difficult, may all be considered to be purely obstetrical causes of maternal and fœtal mortality.

Group II. Pre-existing Disease of the Mother.—In all cases in which the mother suffers from any disease of sufficient intensity to be influenced by constitutional changes, labour will be attended by a rate of mortality. There is nothing strange in this. The act of emptying the rectum or bladder is a physiological process, and is unattended by mortality under normal circumstances, but if an individual suffers from cardiac disease, aneurysm, or suchlike pathological condition, the mere natural straining necessary to perform the act of defæcation or micturition may be the *causa causans* which completes the breakdown of the heart or the rupture of the aneurysm. It is not, then, to be wondered at that a process involving so severe a strain on the system as does parturition should be attended with a high rate of mortality in all cases in which it is associated with serious organic disease of the mother.

Group III. Accidental Causes.—Under the heading accidental causes, we include all causes of mortality to which the process of parturition renders the mother liable, but whose occurrence might have been avoided. The principal example of such causes is septic infection. The process of labour renders a parturient woman especially liable to septic infection; but, if due precautions are taken, septic infection in the case of previously healthy women should not occur, and hence there should be no mortality from it. It is a distinctly preventable accident of parturition.

In consequence of the existence of these various causes of mortality during labour, it is impossible to expect that a long series of labours will be unattended by mortality, but, it should be clearly fixed upon the mind of the obstetrician that, in the absence of any of these causes—that is, in the vast proportion of all cases—there should be no mortality. It is possible to go even further than this. At the present day, the science or art of midwifery—whichever it may be termed—has reached so high a pitch of excellence that the obstetrician, who has attained a proper knowledge of his subject, should be able to look forward with confidence to the successful termination of almost every case of purely obstetrical complication. Moreover, modern knowledge of the causes and prevention of sepsis enable him, if he is careful, to almost eliminate all mortality from septic infection. Consequently, the mortality of labour should be entirely attributable to those cases in which we are, at present, powerless to avert the effects of labour on an already broken-down maternal organism.

It will be readily understood that there is a difficulty in estimating what may be considered to be a not undue rate of mortality in all labour cases taken together. It is easy to give the rate of mortality in a particular hospital, or in the practice of a particular obstetrician, but it is difficult to estimate, even approximately, what would have been the mortality of the same patients if they had been confined under more or less favourable circumstances. One thing is, we fear, rendered very obvious by statistics, namely, that the rate of mortality of childbirth has not yet reached the irreducible minimum, but that numerous lives are yearly sacrificed which might have been saved. It may be of some assistance to those who wish to investigate this important subject further if we lay before them three sets of statistics :—

(1) The mortality which occurred during the last ten years (1894-1903) in the wards of the Rotunda Hospital.

(2) The mortality which occurred during the last seven years (1897-1903) in the Extern Department of the Rotunda Hospital.

(3) The mortality which occurred during the last ten years (1894-1903) in England and Ireland, as gathered from the respective returns of the Registrars-General.

In the case of the Rotunda statistics, we have classified the deaths according to the three groups of causes to which we have already referred; but in dealing with the returns of the Registrars-General it was impossible to follow the same procedure. For the purposes of comparison, however, the figures in Groups I. and II. in the Rotunda statistics may be taken as comparable with the figures in the group of deaths from non-septic causes in the returns of the Registrars-General. Also as Group III. in the Rotunda statistics is almost entirely composed of deaths from septic causes, it is comparable with the group of deaths from septic causes in the official returns. In certain cases, the allocation of cases has to be somewhat arbitrary. For instance, there is a difficulty in deciding whether a death from eclampsia should be placed in Group I. or Group II., as, although it is essentially an obstetrical complication, it is almost invariably associated with pre-existing disease. The same remark applies to hyperemesis, and accidental hæmorrhage. We have allocated deaths from eclampsia and hyperemesis to Group II., and deaths from accidental hæmorrhage and pulmonary embolus to Group I. The following table contrasts the statistics of the Intern and Extern Departments of the Rotunda Hospital:—

Intern Department.					Extern Department.				
Total Number of Labours.	Deaths.				Total Number of Labours.	Deaths.			
	Groups.			Total.		Groups.			Total.
	I.	II.	III.			I.	II.	III.	
15,205	15	27	14	56	14,818	23	8	7	38
Percentage of deaths.	0·098	0·11	0·092	0·36	Percentage of deaths.	0·15	0·05	0·04	0·25

These figures are very much what one would expect. We see that, as is natural, the death-rate from purely obstetrical causes is less in the Intern than in the Extern Department. It is impossible that the woman who sends for medical advice and assistance at the last moment, and on whom any necessary operations have to be performed under the most unfavourable circumstances, can be as favourably situated as the woman who enters the wards of the hospital. We next see that the death-rate from pre-existing disease is considerably higher in the Intern than in the Extern Department. This is also natural, as patients who are seriously ill prior to delivery frequently desire to be confined in the hospital, and, consequently, the number of labours terminating what may be called pathological pregnancies is very much greater than in the Extern Department. The relation between the deaths in Group III. is not so easy to explain. It may be assumed that these figures are entirely made up by deaths from sepsis in some form, and why the death-rate should be higher in the Intern than in the Extern Department is not quite obvious. It is most probable that the figures do not represent the true proportion. The figures of the Intern Department are carefully kept and are correct, but it is obviously impossible to keep the figures relating to the Extern Department with the same completeness. Consequently, it is probable that the percentage of deaths in the Extern Department from septic infection is higher than the figures show.

In the next table, the combined statistics of the Intern and Extern Departments of the Rotunda Hospital are contrasted with the general statistics of the country at large:—

ROTUNDA HOSPITAL: COMBINED INTERN AND EXTERN DEPARTMENTS.				ENGLAND AND IRELAND: RETURNS OF REGISTRARS-GENERAL.			
Total Number of Labours.	Deaths.			Total Number of Labours.	Deaths.		
	Groups.		Total.		Groups.		Total.
	I. and II.	III.			Non-septic Causes.	Septic Causes.	
30,023	73	21	94	10,290,289	28,646	22,231	50,877
Percentage of deaths.	0·204	0·066	0·27	Percentage of deaths.	0·278	0·216	0·494

A comparison of the combined statistics of the Intern and Extern Departments of the Rotunda Hospital with those of the country at large is most instructive. In the first place, it shows that the deaths from strictly obstetrical causes and from pre-existing disease are even less in hospital practice than amongst outside cases, although it is fair to assume that the number of abnormal and complicated labours is considerably greater in hospital practice. In the second place, it shows that, whereas the death-rate from septic infection in hospital practice was 6 per 10,000 labours, the rate throughout the country was 21 per 10,000 labours, or more than three times as many. This, too, in spite of the fact that almost half the cases included in the Rotunda statistics were confined in the hovels of the poor under the most unfavourable circumstances; and that amongst the other half—*i.e.*, those confined in the hospital—it is but natural to expect a greater number of cases who were unduly prone to septic infection.

It is no easier to obtain a definite idea of what may be considered to be an average rate of mortality amongst infants than it is amongst mothers. The following table of statistics of the Clinique Baudelocque shows the mortality amongst infants delivered spontaneously or by the aid of the forceps during five years, infants dead-born in consequence of eclampsia alone excluded:—

Total Number of Confinements.		Infants died during Labour.	Infants died after Birth.
Primiparæ - -	3,686	14	113
Multiparæ - -	4,321	16	108
Total - -	8,007	30	221

According to this table, the total infant mortality during birth under the conditions stated above was 0·37 per cent., or 1 in 266·9, and the infant mortality after birth 2·76 per cent., or 1 in 36·23. If from the total number of deaths after birth, 138 children are excluded who died as a result of prematurity or of congenital malformations, it will be seen that the percentage of those who died after birth was 1·05, or 1 in 96·47. If, however, all cases of labour—save abortions—are included, we shall get very different results, as is shown by the following table, compiled from the statistics of the Rotunda Hospital for the past seven years:—

		Average.
Total number of births - - - - -	10,803	
Immature births, recent - - - - -	64	1 in 168·8
Premature births, recent - - -	109	1 in 99·1
Full-term births, recent - - - -	212	1 in 50·95
Macerated - - - - - - -	207	1 in 52·18
Putrid - - - - - - - -	13	1 in 815·61
Total number born dead - - -	605	1 in 17·85
Infants born alive who died in hospital - -	248	1 in 43·56
Total number born dead or died in hospital -	853	1 in 12·54

CHAPTER III

CEPHALIC PRESENTATIONS

Vertex Presentation — Frequency — Ætiology — Positions — Diagnosis — Mechanism ; First Position ; Second Position — Abnormalities of Mechanism ; Hyper-rotation of Head ; Reversed Rotation of Shoulders ; Reversed Rotation of Head ; Lateral Obliquity of Head, Posterior Asynclitism, Anterior Asynclitism—Moulding.

The term 'cephalic presentation' includes all presentations in which the head lies lowest. The frequency and the causes of cephalic presentation have been already mentioned. It occurs in 96·66 per cent. of all cases,* or, if only full-time cases are taken into account, in 97·36 per cent.† The different cephalic presentations must be discussed separately.

VERTEX PRESENTATION

The term 'vertex presentation' is applied to that presentation in which the head presents and the vertex, or space between the anterior and posterior fontanelles bounded laterally by the parietal eminences, lies lowest.

Frequency.—The relative proportion of cases in which a vertex presentation occurs depends greatly upon the period of pregnancy at which delivery takes place and upon the condition of the fœtus. At the seventh month, vertex presentations are said to occur in 83 per cent. of cases in which the fœtus is alive, and in 53 per cent. of cases in which the fœtus is dead (Churchill). Before the seventh month the percentage of vertex presentations is less, while at full term vertex presentation occurs in 97 per cent. of living children, and in 80 per cent. of macerated fœtuses (Collins). If all cases of labour occurring after the fourth month are grouped together, vertex presentation occurred in 96·22 per cent. (Rotunda Hospital).

Ætiology.—It is not necessary to again enter at any length into the causes of vertex presentation, inasmuch as they have been already fully discussed. Cephalic presentations are the result of the relation between the shape of the fœtus and the shape of the

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* Rotunda Hospital. † Pinard and Lepage.

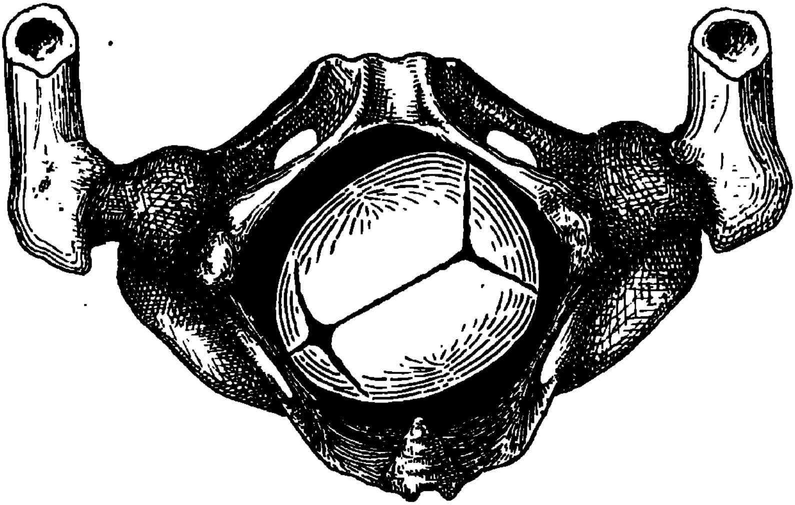

FIG. 165.—FIRST VERTEX PRESENTATION, WITH THE BACK IN FRONT. The head presenting at the brim, as felt by vaginal examination.

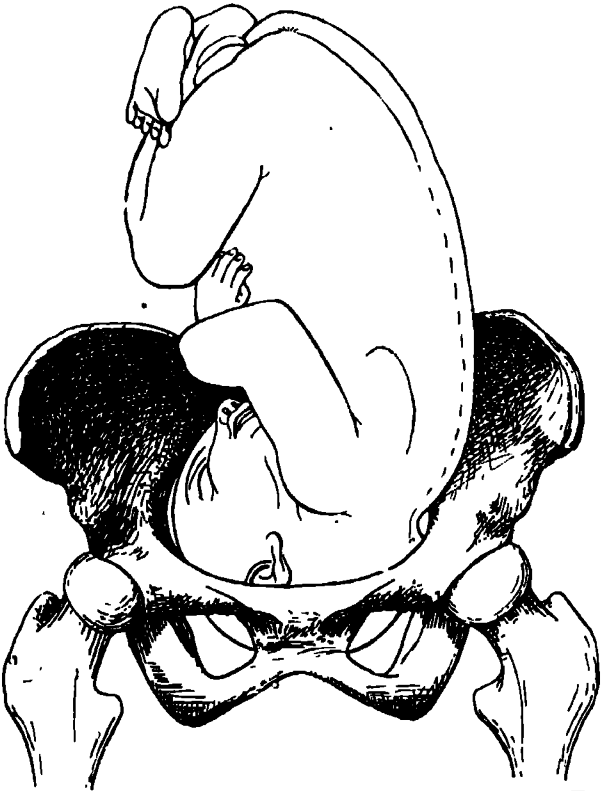

FIG. 166.—FIRST POSITION OF THE VERTEX, THE BACK IN FRONT. (Farabœuf.)

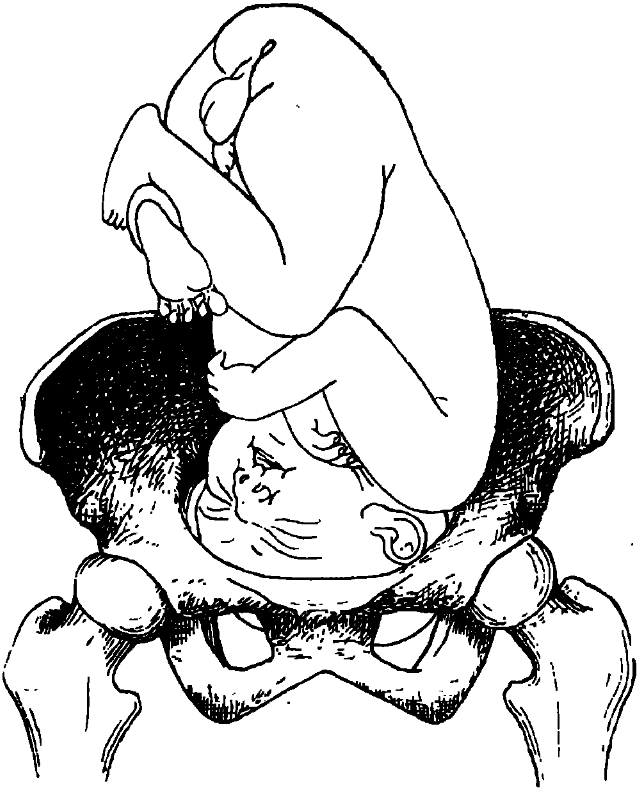

FIG. 167.—FIRST POSITION OF THE VERTEX, THE BACK BEHIND. (Farabœuf.)

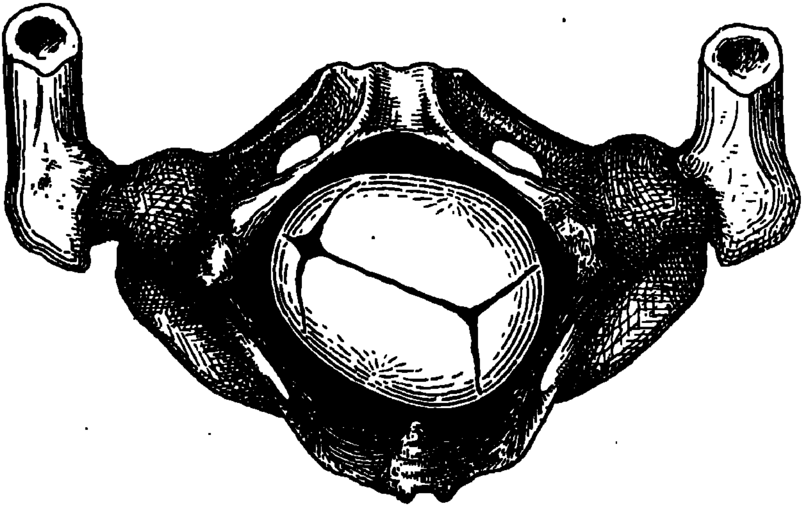

FIG. 168.—FIRST VERTEX PRESENTATION, WITH THE BACK BEHIN. The head presenting at the brim, as felt by vaginal examination.

ovum, of the action of gravity upon the fœtus, and of the movements of the latter. Once a cephalic presentation occurs, the vertex naturally presents in consequence of the normal attitude of the fœtus.

Positions.—The fœtus may lie in one of two positions, as has been already mentioned, according as the back is turned towards the left or the right side, and in each of these positions the back may be directed anteriorly or posteriorly. In this way are got the four positions of Naegele. The different positions may then be classified as follows:—

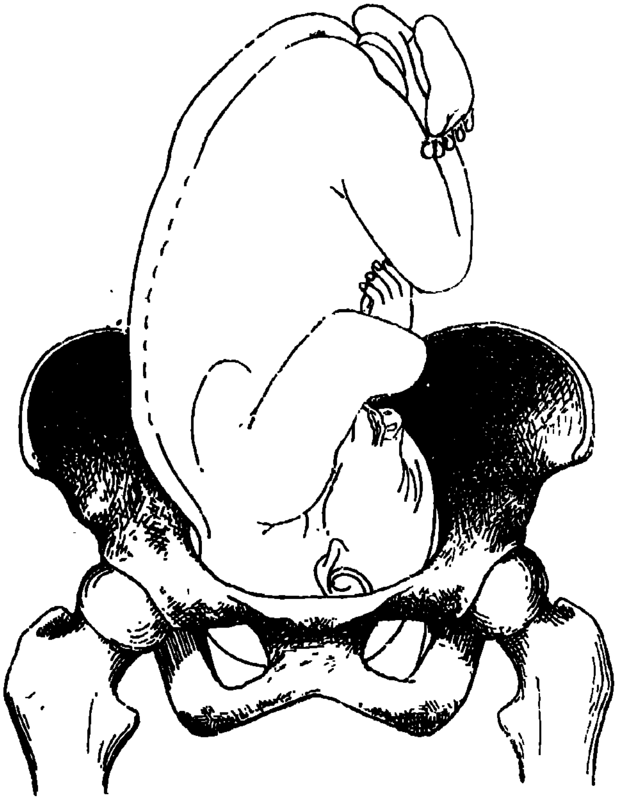

FIG. 169.—SECOND POSITION OF THE VERTEX, THE BACK IN FRONT. (Farabœuf.)

First position, back to the left, and	In front, first position of Naegele, sometimes termed the left occipito-anterior, or, shortly, L.O.A.
	Behind, fourth position of Naegele, the left occipito-posterior, or L.O.P.

Second position, back to the right, and
- In front, second position of Naegele, the right occipito-anterior, or R.O.A.
- Behind, third position of Naegele, the right occipito-posterior, or R.O.P.

The difference in the relative frequency of these positions is very marked. The first position, with the back in front (first position of Naegele), is much the most common, and next in frequency comes the second position, with the back posteriorly (third position of Naegele). According to Naegele, one or other of these two positions occurs in 99 per cent. of vertex presentations, and the statistics of more recent French writers appear to support this statement.

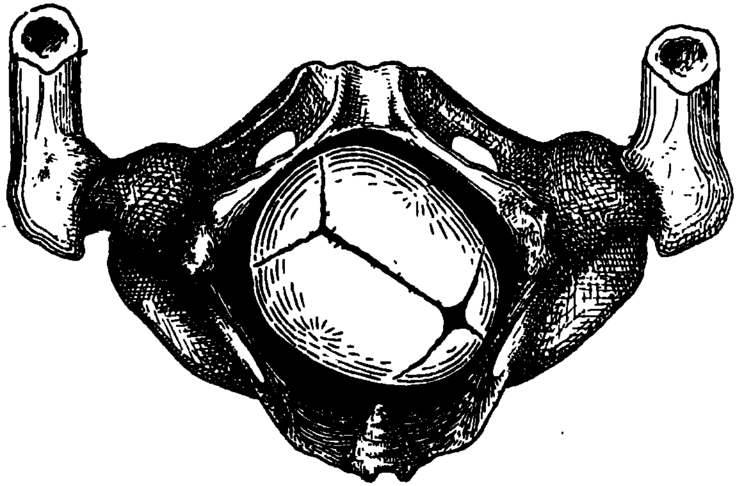

FIG. 170.—SECOND VERTEX PRESENTATION, WITH THE BACK IN FRONT. The head presenting at the brim, as felt by vaginal examination.

The statistics of Pinard and others* taken together are as follows:—

Position.	Back in Front.	Back Behind.	Total.
First	62·83	5·64	68·47
Second	0·99	30·54	30·53

The ~~causes of the frequency with which the~~ transverse diameter

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* Ribemont-Dessaignes and Lepage, 'Précis d'Obstétrique,' p. 347.

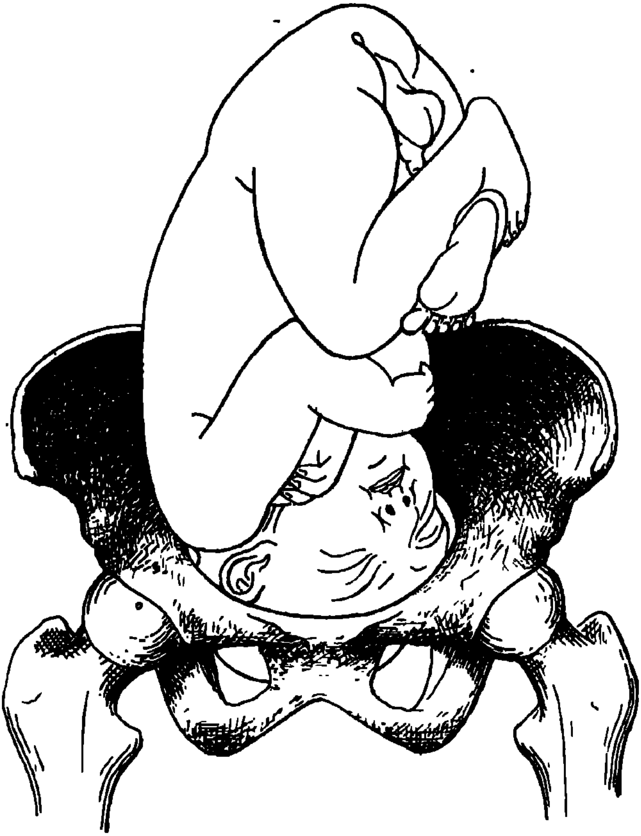

FIG. 171.—SECOND POSITION OF THE VERTEX, THE BACK BEHIND. (Farabœuf.)

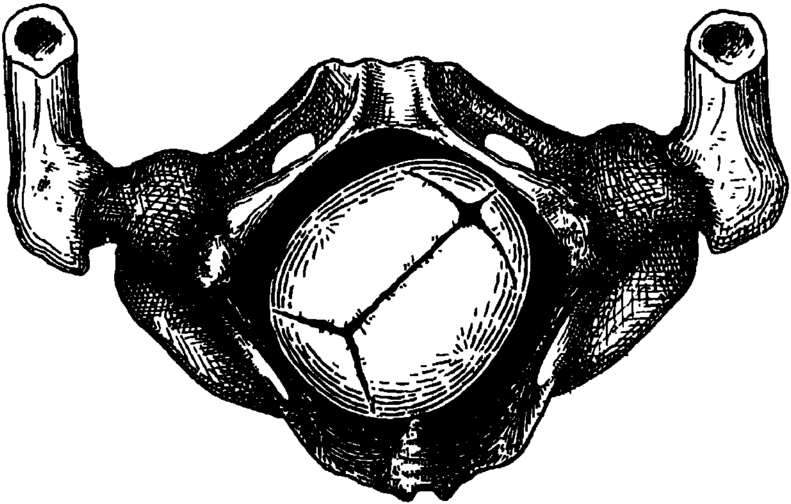

FIG. 172.—SECOND VERTEX PRESENTATION, WITH THE BACK BEHIND. The head presenting at the brim, as felt by vaginal examination.

of the fœtus corresponds with the left oblique diameter of the pelvis are probably as follows:—

(1) The tendency of a shoulder to lie in the right anterior quadrant of the pelvis in consequence of the action of gravity.

(2) The tendency of the antero-posterior diameter of the fœtus to correspond to the right oblique diameter of the pelvis as a result of the usual dextro-torsion of the uterus.

(3) The tendency for the antero-posterior diameter of the fœtal head to lie in the right oblique diameter of the pelvis in consequence of the fact that the right oblique diameter is longer than the left.

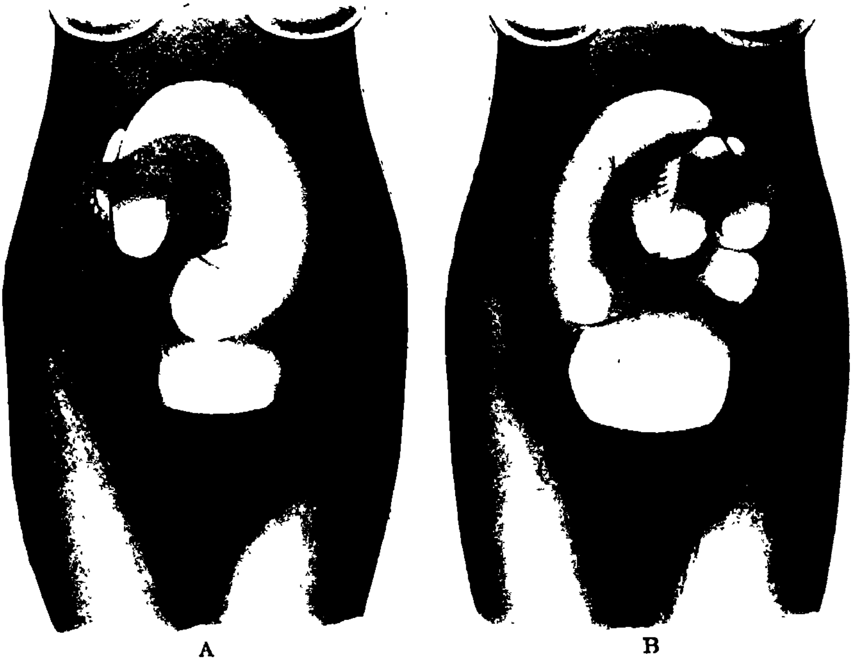

FIG. 173.—DIAGRAM REPRESENTING THE FŒTUS AS FELT BY ABDOMINAL PALPATION IN VERTEX PRESENTATION.

The unshaded portions of the fœtus are those which are felt most distinctly A, First vertex, back in front; B, second vertex, back behind.

Diagnosis.—The diagnosis of vertex presentation can be made by abdominal palpation, vaginal examination, and auscultation.

Abdominal Palpation.—The pelvic pole of the fœtus is found at the fundus of the uterus, and is distinguished from the cephalic pole by the following signs:—

(1) It is less mobile.

(2) There is no groove or depression between it and the body, and in some cases the feet can be felt beside it.

(3) It is slightly larger; but this sign is not of much value unless the head is sufficiently far above the brim to render it possible to make a comparison.

(4) It is not so hard.

The lie of the fœtus is found to be longitudinal, with the back turned towards one or other side, according to the position. The head is found in the lower pole of the uterus, if it has not passed completely into the pelvic cavity. It is recognised by the fact that it is slightly harder and rounder than the breech, that there is a groove between it and the body, and that if it is not fixed in the brim it ballottes slightly from side to side. The groove of the neck lies obliquely in the uterus, and is lowest on the side of the fœtal back. If the head has passed in great part into the pelvic cavity, the fingers can be pushed more deeply into the cavity on the side of the back than on the side of the limbs (*v.* Fig. 173).

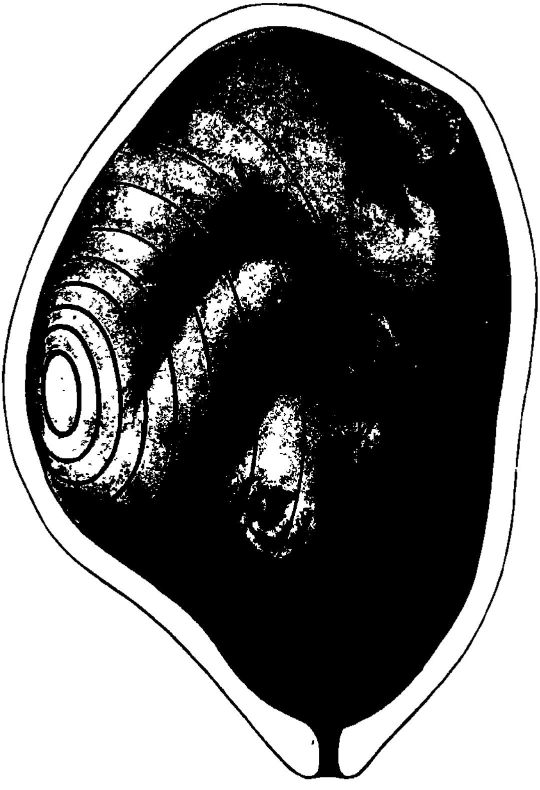

FIG. 174.—SITE OF MAXIMUM INTENSITY OF HEART-SOUNDS WHEN THE HEAD IS FLEXED. (Bumm.)

Vaginal Examination.—A smooth, rounded tumour is felt either lying at the pelvic brim or in the pelvic cavity, and on it the sutures and fontanelles can be recognised. At the commencement of labour, the interparietal suture corresponds approximately to one or other oblique diameter of the pelvis and crosses the most dependent portion of the presenting part. At either end of the suture the anterior and posterior fontanelles can be found lying at approximately the same level, and radiating from them their respective sutures. At a later stage of labour, in consequence of flexion and rotation of the head, the posterior fontanelle occupies a relatively deeper position in the pelvis than does the anterior fontanelle, and at a still later stage, it forms the presenting point from which the interparietal and lambdoidal sutures radiate. These points will be more readily understood by reference to the accompanying diagrams.

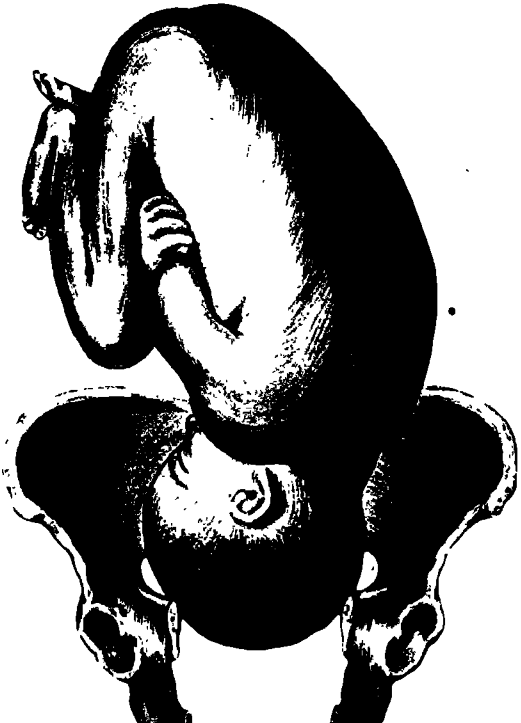

FIG. 175.—THE MECHANISM OF FIRST VERTEX PRESENTATION.
The head at the brim at the commencement of labour, the vertex presenting.

The position of the fœtus is ascertained by noting the relation of the fontanelles to the pelvis. In the first position, the posterior fontanelle lies in relation to the left half of the pelvis, and either in front of or behind the median coronal plane of the pelvis. In the second position, the posterior fontanelle lies in relation to the right half of the pelvis, and either in front of or behind the same plane.

Auscultation.—The point of maximum intensity of the fœtal heart sounds, in cases of vertex presentation, is usually situated over the back of the fœtus, at one or other side of the middle line, and slightly below the level of the umbilicus (*v.* Fig. 174).

Mechanism.—By the term 'mechanism of labour' is meant the various changes of attitude and position which the fœtus undergoes in order to best adapt the different diameters of its head and body to the different diameters of the pelvis. It is a process which it is frequently most difficult for the student to understand, and so we shall devote a few lines to trying to explain its rationale.

The first point to grasp is the necessity for a definite mechanism. If the student recalls the various measurements of the fœtal head and of the pelvis, he will find that in order that the head may enter the pelvic brim it has to lie in one of several positions, in order that its diameters may be smaller than the corresponding diameters of the pelvis. When the head lies at the brim in its normal attitude, the vertex presenting, the occipito-frontal diameter is the greatest engaging diameter. It, however, measures 4½ inches, whereas by an alteration in the attitude of the head the sub-occipito-bregmatic diameter can be substituted, which measures only 3¾ inches. This substitution of a smaller diameter for a greater is obtained by the flexion of the head, and enables the latter to adapt itself to the outline of the brim. As, however, the relation between the antero-posterior and the transverse diameters of the pelvis are different at different levels of the pelvis, so the head will have to alter its position with regard to the pelvis in order that its greatest engaging diameter may always correspond to the greatest diameter of the pelvis at the particular level which it has reached. In other words, at the pelvic brim the transverse and oblique diameters of the pelvis are greater than the conjugate, while at the outlet the reverse is the case. Accordingly, when the head is passing through the brim as a vertex presentation its greatest engaging diameter—*i.e.*, the sub-occipito-bregmatic diameter—must lie in the oblique or transverse diameter of the pelvis, and when it is passing through the outlet its sub-occipito-bregmatic diameter must lie in the antero-posterior diameter of the outlet. Similarly, when the shoulders are passing through the brim their bis-acromial diameter must correspond to the oblique or transverse diameter, and when passing through the outlet to the antero-posterior diameter. The movement which brings about this alteration in the position of the fœtus is known as a rotation, and we shall see presently that there are two distinct rotations.

Further, the parturient canal is, as we know, in the form of a curve with its concavity directed forwards, and in order to traverse this curve the head must keep its long axis—*i.e.*, in a vertex presentation its mento-occipital diameter—approximately in the axis of the curve. Consequently, whereas in passing through the brim the long axis of the head points towards the tip of the coccyx, as the head descends it points more and more forwards, until as the head is passing through the outlet it lies almost at right angles to its former position. In order that this change of direction may occur a change in the attitude of the head is necessary, and this change is brought about by a gradual movement of the head from a position of flexion to one of extension.

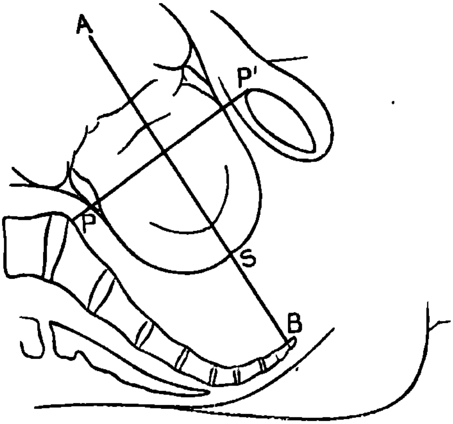

FIG. 176.—SYNCLITIC ENGAGEMENT OF THE HEAD.

We thus see that in a vertex presentation the head undergoes, first, a movement of flexion, which brings its smallest diameters into the pelvic brim; then, a movement of rotation, which keeps its greatest engaging diameter in the greatest diameter of the pelvic cavity; and, at more or less the same time, a movement of extension, which keeps its long axis in the long axis of the parturient canal. Lastly, as the shoulders pass through the pelvis there is another movement of rotation, in order to keep their bis-acromial diameters in the greatest diameters of the pelvis.

We must now describe these various movements systematically, but before doing so we would urge on the student the advisability of following them either by means of a comprehensive series of diagrams, or, better, with a pelvis and mannikin. If the latter are not at hand, a cast of a fœtal head will answer most purposes.

The mechanism of a vertex presentation is usually described as consisting of five distinct acts:—

(1) Descent.
(2) Flexion.
(3) Internal rotation.
(4) Extension.
(5) External rotation.

It must be clearly understood that the foregoing are not distinct stages in the mechanism of labour, in that they do not regularly succeed one another. The act of descent precedes and accompanies all the other acts, and internal rotation and extension occur at very much the same time.

(1) **Descent.**—As we have already seen, the force of the uterine contractions is transmitted to the fœtus in two ways. It is transmitted as a 'general contents pressure' and as a 'fœtal axis pressure' (*v.* Figs. 155-157). The former is called into play when there is sufficient liquor amnii round the body of the fœtus to prevent the fœtus from being directly pressed upon by the uterine wall, and produces a force acting uniformly over the base of the skull. The latter comes into play after the uterine wall has contracted down upon the body of the fœtus, and produces a force acting straight downwards through the axis of the fœtal body and transmitted to the head through the vertebral column. These two forces bring about the descent of the fœtus. The manner in which the head enters the pelvis has been the subject of a considerable amount of discussion. As we know from the study of

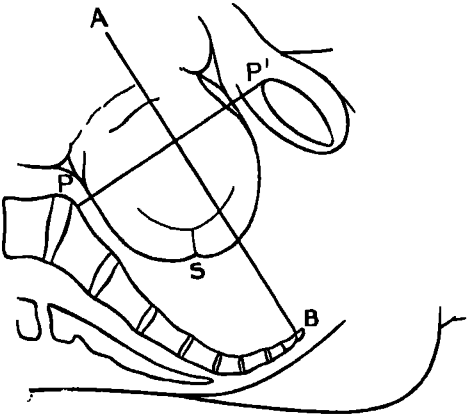

FIG. 177.—POSTERIOR ASYNCLITISM OF THE HEAD.

frozen sections, in a vertex presentation the head commences to engage in the brim, with its median sagittal plane corresponding to one or other of the oblique diameters of the brim, and with its median coronal plane corresponding to the opposite oblique diameter. This position of the head is termed Solayrés' obliquity.* Further, the head enters the brim, with its vertical axis at right angles to the plane of the brim. It is not at first very obvious why the head should enter the brim, with its long engaging diameters corresponding to the oblique diameters; but it is, in all probability, due to the pre-existing position of the fœtus. In certain cases—notably, of flat pelvis, Solayrés' obliquity is absent, and the head engages with its antero-posterior diameters corresponding to the transverse diameter of the brim.

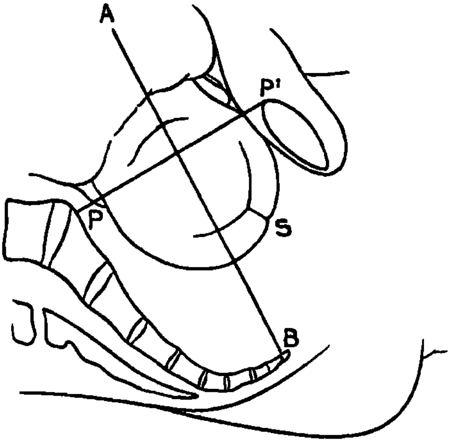

FIG. 178.—ANTERIOR ASYNCLITISM OF THE HEAD.

The relation of the long axis of the head to the plane of the pelvis at the brim and in the cavity has long been the subject of discussion. The head may enter the brim in one of three ways. First, its long axis may coincide with the axis of the brim (*v.* Fig. 176). In such a case, the head is said to engage in a synclitic manner, the two parietal bones pass through the brim simultaneously, and the sagittal suture intersects the true conjugate diameter at a point equidistant from the promontory and the symphysis. Secondly, the long axis of the head may lie in front of the axis of the brim (*v.* Fig. 177). In such a case, the head is said to be in a position of posterior asynclitism, or Naegele's obliquity. The anterior parietal bone—*i.e.*, the parietal bone in relation to the symphysis—is in advance of the posterior parietal bone, and the sagittal suture intersects the true conjugate diameter at a point nearer the promontory than the symphysis. Thirdly, the long axis of the head may lie behind the axis of the brim (*v.* Fig. 178). In such a case, the head is said to be in a position of anterior asynclitism or Litzmann's obliquity—*i.e.*, the posterior parietal bone is in advance of the anterior parietal bone, and the sagittal suture intersects the true conjugate diameter at a point nearer the symphysis than the promontory. We do not propose to enter into a discussion on this subject, as to do so would entail the devotion to it of more space than the practical importance of the question necessitates. It is sufficient to say that the great majority of observers are agreed that the head passes through the pelvis in a synclitic manner, its axis always more or less exactly coinciding with the axis of the pelvic canal. Before the fixation of the head in the brim, many consider that the head is inclined on its posterior parietal bone (Litzmann's obliquity), and that during the engagement of the head this obliquity is corrected.* In certain cases, Naegele's or Litzmann's obliquity may occur,

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* 'Dissertatio de partu viribus maternis absoluto.' Paris, 1771.

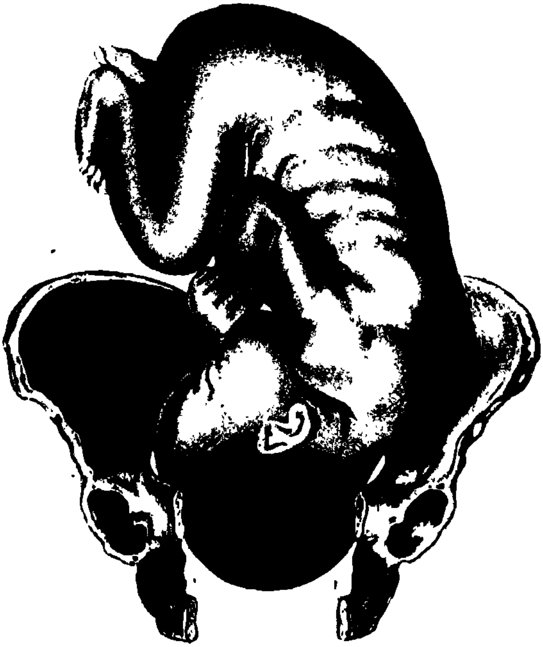

FIG. 179.—THE MECHANISM OF FIRST VERTEX PRESENTATION.
Flexion is complete, and the posterior fontanelle is presenting.

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* Pinard and Varnier, 'Études d'Anatomie obstétricale normale et pathologique,' p. 74.

just as in certain cases Solayrés' obliquity may be absent; but these are all cases in which the normal relation between the size of the head and the pelvis is altered. They will be referred to subsequently.

(2) **Flexion.**—The second act in the mechanism of labour is the completion of flexion of the head (*v*. Fig. 179). As we already know, the normal position of the head of the fœtus in the uterus is one of partial flexion, and in consequence of this the engaging diameter at the commencement of labour is one between the sub-occipito-bregmatic and the occipito-frontal diameters, and the vertex is the presenting part. As the head passes through the brim, the degree of flexion present increases. Two results follow from this:—the sub-occipito-bregmatic diameter becomes the engaging diameter, and the posterior fontanelle becomes the presenting point (*v*. Fig. 180). The cause of flexion depends upon the nature of the force which is acting upon the fœtus. We have seen that two forces may act upon the fœtus:—one, the general contents pressure acting equally over the base of the skull; the other, the fœtal axis pressure acting along the axis of the fœtus, and transmitted to the head, at first through the vertebral column. The explanation of the manner in which the general contents pressure causes flexion is somewhat complex; but the explanation of flexion, once fœtal axis pressure has come into existence, is simple.

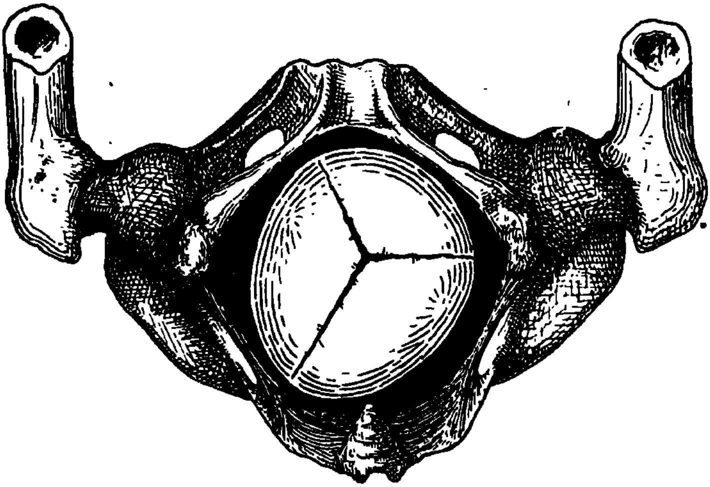

FIG. 180.—FIRST VERTEX PRESENTATION.
The head after flexion has occurred, as felt by vaginal examination.

Flexion resulting from general intra-uterine pressure alone is due to the shape of the head. As we have mentioned, this pressure acts as a uniform force over the base of the skull, and so, if the resistance to the descent of the head was equal on all sides, would cause a simultaneous descent of all parts of the head. Owing to the pre-existing partial flexion of the head, the occiput where it meets with the resistance of the brim is comparatively sheer, and consequently slips readily past the brim. The sinciput, on the other hand, is more prominent and tends even to project slightly beyond the margin of the brim, and, in consequence, there is more or less resistance to its descent

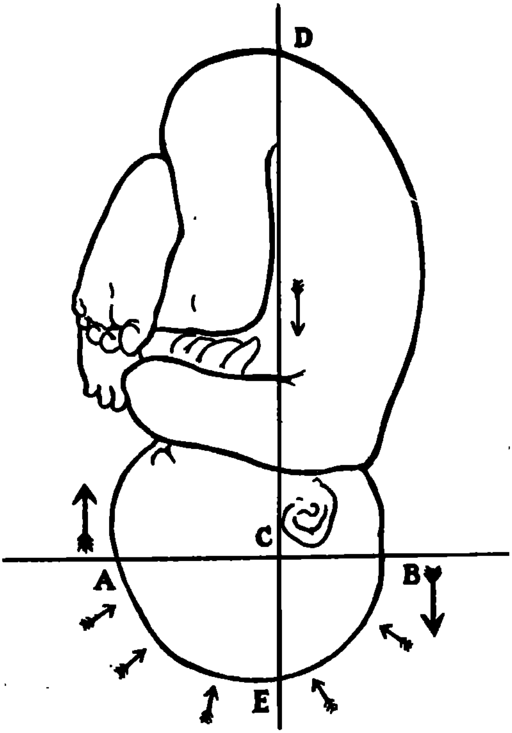

FIG. 181.—DIAGRAM TO SHOW THE METHOD IN WHICH FLEXION IS PRODUCED BY FŒTAL-AXIS PRESSURE ACTING UPON THE HEAD.

DE, Line of fœtal-axis pressure; AB, engaging plane of head.

according as the head is large or small in comparison with the pelvis. In normal cases, where the antero-posterior engaging diameter has almost sufficient room to pass easily through the oblique diameter, the pre-existing degree of flexion is but slightly increased. When, however, the oblique diameter of the brim is narrowed, and when, consequently, considerable obstruction is offered to the engaging diameter of the head, flexion is exaggerated. In such cases, flexion may proceed so far that the occipital bone constitutes the presenting part. This excessive flexion of the head is known as Rœderer's obliquity.

The manner in which fœtal axis pressure causes flexion is very simple. The first effect of the uterine contractions, after the liquor amnii has in great part escaped, is to straighten out the previously curved fœtal body. Then, the force of the contraction is transmitted to the breech, and constitutes a force acting downwards through the axis of the fœtal body. This force is at first transmitted to the head through the occipital condyles, and consequently acts on the base of the skull at a point nearer the occiput than the sinciput. Accordingly, the occiput is driven down until the chin comes into contact with the chest. This process will be readily understood by reference to the accompanying diagram (*v.* Fig. 181). The fœtal axis pressure acting along a line DE acts on the engaging plane AB of the head at a point C. Supposing that the resistance to the descent of each end of this plane is equal, then as CB is shorter than CA, the end B of the plane will tend to descend more rapidly than the end A, and, as DC is itself descending, flexion will consequently occur. Further, as we have seen that there is less resistance to the descent of B than to the descent of A, the occiput will descend still more rapidly.

(3) **Internal Rotation.**—As soon as the advancing head has reached the floor of the pelvis, the next act in the process of labour—that of internal rotation—commences. On the termination of flexion, the head is advancing in such a position that its small fontanelle constitutes the presenting point, and its sub-occipito-bregmatic diameter corresponds to the oblique diameter of the pelvis. In consequence of the occurrence of internal rotation, the head now commences to rotate round its long axis in such a direction that the occiput moves forward from whatever end of the oblique diameter it occupied until it comes to lie in the arch of the pubis. Consequently, when the movement is complete, the antero-posterior diameter of the head corresponds with the antero-posterior diameter of the outlet of the pelvis (*v.* Figs. 182, 183).

The causes of internal rotation are to be found in the shape of the fœtal head, and in the alteration which takes place from above downwards in the respective lengths of the diameters of the pelvis. At the pelvic brim, the oblique and transverse diameters are greater than the conjugate; but, at the outlet, the antero-posterior diameter is the greater. Consequently, as there is a natural tendency for the large engaging diameters of the head to adapt themselves to the large diameters of the pelvis, the head rotates as it descends in such a manner as to bring those diameters which were in the oblique diameter of the pelvis into the antero-posterior diameter. The shape of the pelvis and the resistance offered by the perinæum and vaginal walls are also important factors in the production of internal rotation. If either lateral half of the bony pelvis is considered separately, it will be seen that the inner surface of the ischium resembles a portion of a helix of such a curve that if a rounded body, such as the fœtal head, is driven downwards through the pelvis with sufficient force, and if, at the same time, it is kept in close apposition with this inner surface or anterior inclined plane of the ischium, it will be gently guided forwards until its lowest portion

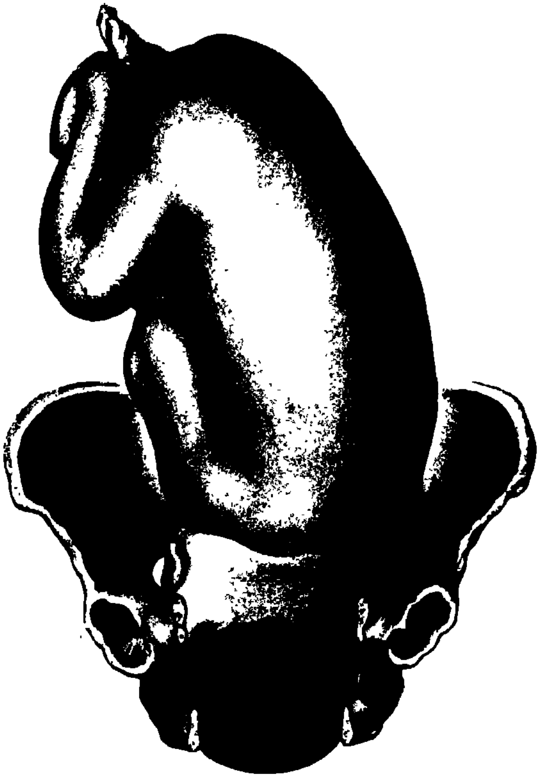

FIG. 182.—THE MECHANISM OF FIRST VERTEX PRESENTATION.
Internal rotation is complete, and the occiput lies behind the symphysis.

comes to lie in the pubic arch. This tendency to forward rotation is increased by the fact that there is less resistance to the advance of the presenting part under the pubic arch than elsewhere, as the resistance of the vaginal walls and perinæum obstruct its descent posteriorly. It is thus seen that the movement of internal rotation is, in fact, identical with the turning of a screw in its socket, the fœtal head forming the screw, the genital canal the socket.

The length of the turn depends upon the position of the lowest portion of the presenting part—*i.e.*, in the case of a vertex presentation the region round the posterior fontanelle. If the fœtus lies with its back anteriorly—that is, with the occiput at the anterior extremity of either oblique diameter, then internal rotation takes place through one-eighth of a circle. If, on the other hand, the occiput is in relation to the posterior end of the oblique diameter, internal rotation takes place through three-eighths of a circle. It may be considered to be a definite law governing internal rotation that whatever part of the presenting part is lowest will rotate in front. In a vertex presentation under normal circumstances, the occipital end of the head is the lowest, and consequently it rotates forwards. If, as sometimes happens, the sinciput lies lowest, then internal rotation takes place in the opposite direction, and the forehead is rotated forwards.

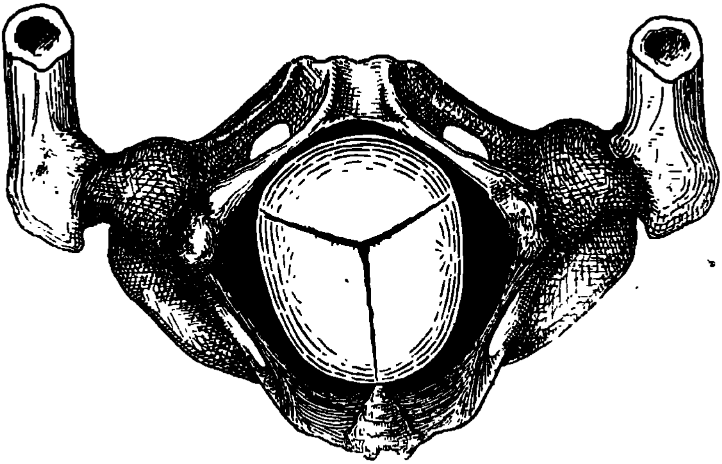

Fig. 183.—First Vertex Presentation.
The head after internal rotation has occurred, as felt by vaginal examination

The factors which cause or assist in internal rotation of the occiput may then be summed up as follows :—

(*a*) The helical shape of the internal surface of the ischium.

(*b*) The alterations in the respective length of the diameters of the pelvis from above downwards.

(*c*) The fact that there is less resistance offered to the advance of the head anteriorly than posteriorly.

(*d*) A fœtal head of sufficient size to fill the pelvis, and a firm resistance posteriorly from the perinæum and vaginal walls. This resistance serves the double purpose of preventing the posterior rotation of the occiput and of maintaining the head in firm contact with the pelvic wall, so ensuring that the rotatory effect of the ischial helix will be produced.

(*e*) A sufficient degree of flexion to bring the occiput lowest.

(*f*) Strong uterine contractions to drive the presenting part onwards.

(4) **Extension.**—The movement of extension of the head is the opposite of flexion, and consists in a backward rotation of the head about a transverse axis. It commences as soon as the presenting head has reached the pelvic floor, and it continues until the head is born. Its effect is to bring the head from a position of flexion to one of extension, and so to enable it to follow the forward curve of the genital canal, and to emerge from the genital passages. The occiput of the fœtus appears at the vulva and slowly distends the opening. The chin then leaves the chest, and, as the presenting part descends, the occiput advances until a point about the occipital prominence comes to lie beneath the symphysis. This point then fixes itself against the symphysis, and the head rotates round it in such a manner that the vertex, the anterior fontanelle, the brow, and the face successively appear from behind the perinæum. Extension is then complete.

The cause of extension is very simple. The forces which act on the head of the fœtus are the driving force of the uterus and the resistance of the perinæum and of the muscles of the pelvic floor, and their resultant is a force acting along a line which is directed forwards and slightly downwards. In order that the head may move in this direction, extension must take place. The active contractions of the levator ani muscle supplement the passive resistance of the other structures of the pelvic floor, and assist in driving the head forwards. This muscle has been already mentioned as forming an important part of the pelvic floor. In its uncontracted condition it forms the concave sides of a kind of gutter or groove, in which, during a part of the stage of expulsion, the fœtal head lies. When the muscle contracts, this groove becomes shallower, and so pushes forward anything which may be lying in it. In this manner, extension is brought about.

(5) **External Rotation.**—As has been already mentioned, internal rotation brings the head into such a position that its antero-posterior diameters correspond with the antero-posterior diameters of the pelvic outlet, and in this position the head is born. The first movement which it makes once it is free from the restraint of the vaginal walls and pelvic structures is one which brings its antero-posterior diameters again into correspondence with the oblique diameter of the pelvis in which it entered the brim. Then, as the body of the fœtus descends through the pelvis, the head rotates a little further in the same direction until the occiput points to one or other thigh. These two movements are generally grouped together under the head of external rotation. The

former of them is, however, owing to its cause, more preferably termed *restitution*, inasmuch as it is caused by the natural inclination of the head to return to its usual position with regard to the shoulders. When the head entered the brim in one oblique diameter, the shoulders were lying above the brim with their bis-acromial diameter corresponding to the opposite oblique diameter, and in this position they subsequently entered the pelvis as soon as the head had sufficiently descended to permit them to do so. Accordingly, when the head rotated into the antero-posterior diameter of the pelvis, as a result of internal rotation, it became slightly twisted with regard to the shoulders, and, consequently, its first movement when born is to correct this twist, and to return to its correct position. This rotation of the head after its birth takes place through one-eighth of a circle, and is known as *restitution* (*v.* Fig. 184). The second movement constitutes *external rotation proper*, and is the result of the

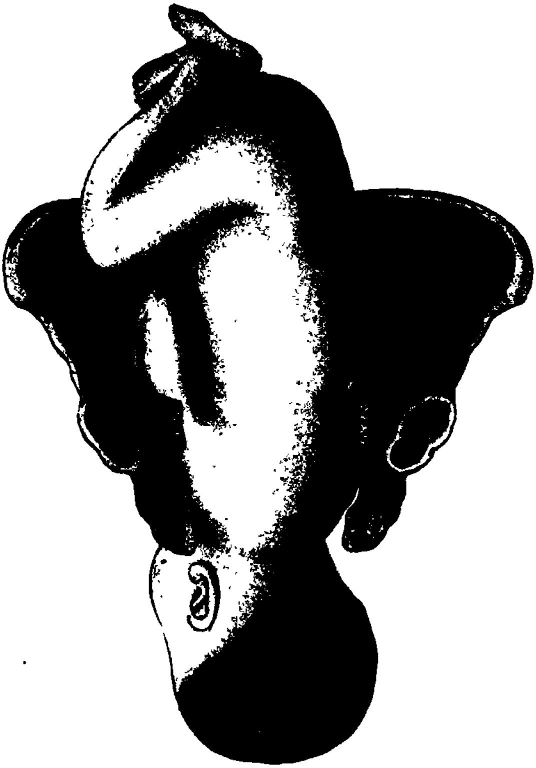

FIG. 184.—MECHANISM OF FIRST VERTEX PRESENTATION.
Extension is complete and the head is born. Restitution has occurred.

internal rotation of the shoulders (*v.* Fig. 185). As we have just mentioned, the shoulders pass through the brim in the opposite oblique diameter to that in which the head traversed it. And, just as in the case of the head, internal rotation takes place in order to bring the long diameters of the head into relation with the long diameters of the outlet, so internal rotation of the shoulders takes place in order to bring the bis-acromial diameter of the trunk into the antero-posterior diameter of the outlet. The manner in which this rotation occurs is similar to that of the head. The shoulder which first reaches the pelvic floor—and this almost invariably is the anterior shoulder—rotates in front, and

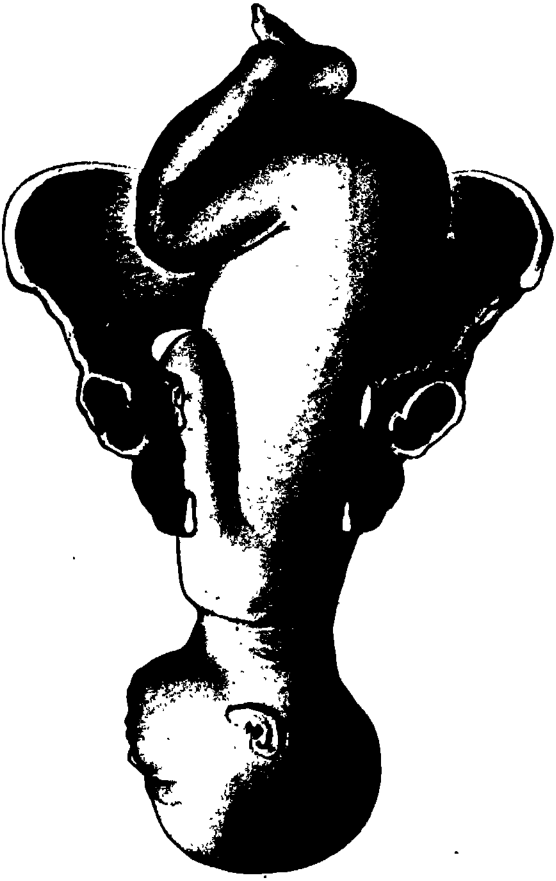

FIG. 185.—MECHANISM OF FIRST VERTEX PRESENTATION.
Internal rotation has occurred, accompanied by external rotation of the head.

comes to lie under the pubic arch. The head naturally follows this internal rotation of the shoulders, and, in consequence, rotates externally in the same direction to that in which restitution occurred, until the occiput points to the thigh. External rotation is then complete.

The Expulsion of the Trunk.—The trunk, like the head, observes a definite mechanism of expulsion. The shoulders, as we have seen, enter the brim in the opposite oblique diameter to that in which the head entered, and traverse the pelvis with the anterior shoulder slightly lower than the posterior. Internal rotation then brings the bis-acromial diameter into the antero-posterior diameter of the outlet, and the anterior shoulder below the arch of the pubes. Under this, it momentarily rests, as did the occiput in the case of the head, while the posterior shoulder pivoting round it sweeps over the perinæum and is born. The anterior shoulder then slips down also, and the delivery of the shoulders is complete. The rest of the body follows, the arms folded across the chest. The hips undergo a similar rotation to the shoulders, and are born with the bi-trochanteric diameter in the antero-posterior diameter of the outlet. As will readily be seen, during the expulsion of the trunk there is a certain amount of latero-flexion and of torsion of the body. Latero-flexion occurs in consequence of the curve of the genital canal, it is greatest at the moment of the expulsion of the shoulders, and it fulfils in the case of the trunk the same object that extension does in the case of the head. Slight torsion of the body also occurs, as while the transverse diameters of whatever part is in the act of passing through the outlet lie in the antero-posterior diameter, the transverse diameters of the part which is passing through the brim lie in the oblique. This is similar to the slight rotation of the head on the neck which occurs during internal rotation, and which restitution corrects immediately the head is free.

The foregoing general description of the mechanism of labour applies to any position of the fœtus. We shall now proceed to describe the mechanism of each position separately.

First Position, Back to the Left.—In the first position, with the back in front—the first position of Naegele, or the left occipito-anterior—the fœtal head enters the brim, with its occipito-frontal diameter corresponding to the right oblique diameter of the brim, the occiput anterior, and the bi-parietal diameter corresponding to the left oblique diameter. Flexion then occurs, and the occipito-frontal diameter is replaced by the sub-occipito-bregmatic diameter. The head descends, and as soon as it reaches the pelvic floor internal rotation occurs and the occiput, which up to this lay at the anterior end of the right oblique diameter, rotates anteriorly and lies under the pubic arch. Extension occurs next, and the brow, face, and chin sweep from behind the perinæum. As soon as the head is free, restitution takes place, and the occiput turns back to its former position. The shoulders descend with their bis-acromial diameter in the left oblique diameter of the pelvis, the anterior shoulder lying at a slightly lower level than the posterior. As soon as the pelvic floor is reached, the anterior shoulder rotates forwards and lies in the arch of the pubes. This movement is accompanied by external rotation of the head in such a direction that the occiput points towards the left thigh of the mother. The remainder of the body is then born as has been described.

In the first position with the back behind—the fourth position of Naegele, or the left occipito-posterior—the head enters the brim with the occipito-frontal diameter corresponding to the left oblique diameter of the pelvis, the occiput posterior and the bi-parietal diameter corresponding to the right oblique diameter. Flexion then occurs, and the occipito-frontal diameter is replaced by the sub-occipito-bregmatic diameter. The head descends, and as soon as it reaches the pelvic floor the occiput, which up to this lay at the posterior end of the left oblique diameter, rotates in front through three-eighths of a circle and comes to lie under the pubic arch. The shoulders which first lay in the right oblique diameter of the pelvis follow this movement, and rotate first into the antero-posterior diameter and then into the left oblique, in which diameter they descend. Extension of the head occurs in the normal manner. As soon as the latter is free, restitution takes place, and the occiput rotates to the left through one-eighth of a circle. As the shoulders descend, the anterior shoulder, which lay at the anterior end of the left oblique diameter, rotates to the front, causing a corresponding external rotation of the head towards the left thigh of the mother. The shoulders and trunk are then born.

Second Position, Back to Right.—In the second position with the back in front—the second position of Naegele, or the right occipito-anterior—the head enters the brim, with its occipito-frontal diameter corresponding to the left oblique diameter of the brim, the occiput anterior and the bi-parietal diameter corresponding to the right oblique diameter. Flexion occurs, and the occipito-frontal diameter is replaced by the sub-occipito-bregmatic diameter. The head then descends until it reaches the pelvic floor, when internal rotation occurs, and the occiput, which up to this lay at the anterior end of the left oblique diameter, rotates to the front and lies under the pubic arch. Extension takes place next, and the head is born. As soon as the latter is free, restitution takes place, and the occiput rotates to the right through one-eighth of a circle. The shoulders descend in the right oblique diameter, the anterior shoulder lower than the posterior. As soon as the pelvic floor is reached, the anterior shoulder rotates in front, and lies under the pubic arch, causing an accompanying external rotation of the head in such a direction that the occiput points towards the mother's right thigh. The shoulders and trunk are then expelled.

In the second position, with the back behind—the third position of Naegele, or the right occipito-posterior—the head enters the brim with the occipito-frontal diameter in the right oblique diameter of the brim, the occiput posterior and the bi-parietal diameter corresponding to the left oblique diameter. Flexion then occurs, and the occipito-frontal diameter is replaced by the sub-occipito-bregmatic diameter. The head descends, and as soon as it reaches the pelvic floor the occiput, which up to this lay at the posterior end of the right oblique diameter, rotates through three-eighths of a circle to the front and lies under the pubic arch. The shoulders, which first lay in the left oblique diameter, accompany this movement, and rotate first into the antero-posterior diameter, and then into the right oblique, in which diameter they descend. Extension of the head occurs in the usual manner. As soon as it is free, restitution occurs, and the occiput turns through one-eighth of a circle to the right. As the shoulders descend, the anterior shoulder, which lay at the anterior end of the right oblique diameter, rotates to the front, causing a corresponding external rotation of the head towards the mother's right thigh. The shoulders and trunk are then born.

Abnormalities of Mechanism in Vertex Presentation.—Various abnormalities in mechanism occur, some of which are of practical importance, while others are merely matters of interest.

Hyper-rotation of the Head.—In a very small proportion of cases in which the fœtus lies in either the first or the second position with the back anterior, the head may rotate too far, and so instead of passing from a position in which the sub-occipito-bregmatic diameter corresponded to the oblique diameter of the pelvis to one in which it corresponds to the antero-posterior, rotation continues until this diameter of the head comes to correspond to the opposite oblique diameter to that from which it started. In such cases, the head is expelled with the occiput fixed under one or other ramus of the pubis instead of under the pubic arch. It is not an anomaly which interferes to any great extent with the progress of labour.

Reversed Rotation of the Shoulders.—As a rule, the anterior shoulder lies slightly lower than the posterior, and consequently, in obedience to the principle which governs internal rotation, rotates forwards during the birth of the trunk. Occasionally, however, it happens that the posterior shoulder lies lowest, and so rotates forwards, travelling through three-eighths of a circle instead of one-eighth. In such a case, external rotation of the head also occurs in the opposite direction to the usual one. In a first position, instead of external rotation, bringing the occiput back through one-eighth of a circle to the side from which it started, it brings the occiput round through three-eighths of a circle to point towards the opposite side. This abnormality does not affect the progress of labour to any important extent.

Reversed Rotation of the Head—Persistent Occipito-Posterior

Position.—This is, perhaps, the most common and important abnormality in the mechanism of vertex presentations, and is said to occur in 1·9 per cent. of cases of this presentation. We have already drawn attention to the principle which governs intrapelvic rotation:—whatever part of the fœtus lies lowest, and so first reaches the pelvic floor, rotates in front. As a rule, in vertex presentation the occiput lies at a lower level in the pelvis than the sinciput, and consequently rotates forwards, even in cases where it was posterior at the commencement. In a small proportion of cases, however, in which the back was posterior at the commencement, it happens that flexion is not complete, and that, consequently, the sinciput is as low as, or, perhaps, even a little lower than, the occiput. In consequence of this, the sinciput tends to rotate forwards, the face lying behind the pubis, and the occiput is carried into the hollow of the sacrum (*v*. Fig. 186).

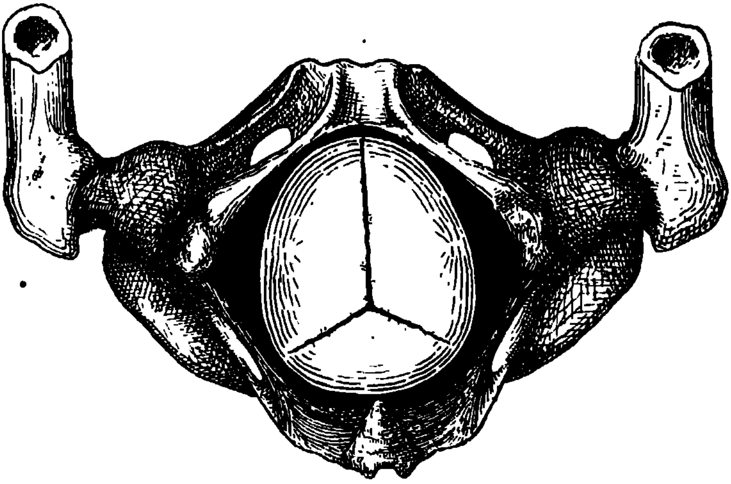

FIG. 186.—REVERSED ROTATION OF THE HEAD.
The head after internal rotation has occurred and the occiput rotated into the hollow of the sacrum.

Incomplete flexion of the head, and hence posterior rotation of the occiput, is more common in cases in which the occiput was primarily directed backwards. It must not, however, be supposed that original occipito-anterior positions never rotate posteriorly. From the statistics of the Baudelocque Hospital, we learn that amongst 8,007 patients posterior rotation of the occiput occurred 44 times; and of these 44 cases, in 17 was the occiput primarily anterior; in 27, primarily posterior (Ribemont-Dessaignes). It may be asked, Why should there be a greater tendency for incomplete flexion in cases of primary posterior position of the occiput than there is in cases of primary anterior position? This is very concisely explained by Herman * as follows:—In the first place, the axis of the upper portion of the utero-pelvic canal is concave backwards. If the fœtus lies with its back in front, then the natural semi-flexed position of its body enables it to so accommodate its abdominal surface to the convexity of the spinal column, that the head can pass through the brim in a position of full flexion. If, however, the back of the fœtus is directed posteriorly, then a certain degree of diminished flexion or of commencing extension must take place in order to allow the head to pass through the brim. In the second place, when the head enters the brim with the occiput anterior, the bi-parietal diameter almost exactly corresponds with one or other oblique diameter of the pelvis, where there is sufficient space for it. If, however, the occiput is directed posteriorly, then the bi-parietal diameter has to fit into a diameter of the pelvis, which is posterior to, and smaller than, the oblique diameter. In consequence, the descent of the occiput is retarded, and a varying degree of extension may be produced, particularly in the case of a large fœtus. In such cases, the further mechanism of delivery is altered, and the head may be expelled in one of the following ways. The sinciput may be the first part of the head to appear. Then the root of the nose fixes beneath the symphysis, and, the head pivoting on this point by a slight movement of flexion, the vertex and occiput in turn appear from behind the perinæum. As soon as the latter is born, a slight movement of extension takes place and the face descends from behind the pubis. In the alternative manner of birth, the head flexes so that the forehead slips up behind the symphysis, and then, the head pivoting around it, the vertex and occiput are born as before by flexion. Finally, a movement of extension occurs, and the sinciput, the face, and the chin appear from behind the symphysis.

In these cases of reversed internal rotation of the head, external rotation is also affected, and the occiput rotates from behind forwards until it points to the thigh corresponding to the side at which it originally lay.

All cases of occipito-posterior position of the vertex, whether subsequently corrected by anterior rotation or not, are more tedious than anterior positions. On an average, labour lasts from two hours to three hours and a half longer in the case of primiparæ, and from one hour to one hour and a half longer in the case of multiparæ, than in the case of anterior positions.† This delay is said by Varnier to occur more during the stage of dilatation than of expulsion, but our own experience would lead us to the opposite opinion. The proportion of cases in which spontaneous delivery occurs is not, however, very much less. In

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* 'Difficult Labour,' 1901 edition, p. 4.

† Ribemont-Dessaignes and Lepage, *op. cit.*, p. 302.

anterior positions spontaneous delivery is said to occur in 94 per cent. of cases, and in posterior positions in 90 per cent.

Lateral Obliquity of the Head.—We have already mentioned that the vertex may traverse the brim in one of three positions, so far as the relation between its long axis and the axis of the brim is concerned. In the first place, the long axis of the head coincides with the axis of the brim, the two parietal bones pass through the brim simultaneously, and the sagittal suture intersects the true conjugate at a part equidistant from the symphysis and the promontory. This is known as synclitic engagement of the head, and is the normal condition. In the second place, the long axis of the head is inclined in front of the axis of the brim, the anterior parietal bone traverses the brim in advance of the posterior, and the sagittal suture intersects the true conjugate at a point nearer the promontory than the symphysis. This is known as posterior asynclitism of the head or Naegele's obliquity. In the third place, the long axis of the head is inclined behind the axis of the brim, the posterior parietal bone traverses the brim in advance of the anterior, and the sagittal suture intersects the true conjugate at a point nearer the symphysis than the promontory. This is known as ant~~erior asynclitism~~ of the head, or Litzmann's obliquity. We have already dealt with synclitic engagement of the head—the normal condition, and we must now deal with the other two.

Posterior Asynclitism.—Posterior asynclitism of the head—Naegele's obliquity[*] or anterior parietal presentation—is the result of such a disproportion between the size of the head and the pelvis, that while there is room in the transverse diameter of the pelvis for the antero-posterior diameters of the head, a narrowing of the antero-posterior diameters of the pelvis prevents the descent of the transverse diameters of the head. As is obvious, such a condition is found in cases of flat pelvis where the transverse diameter of the pelvis is normal, or almost so, but the conjugate is narrowed by the projection of the promontory. In such cases, the head enters the brim with the occipito-frontal diameter corresponding to the transverse diameter of the brim. The descent of the posterior parietal bone is prevented by the projecting promontory, and, the head rotating on its antero-posterior diameter, the anterior parietal bone descends while the posterior remains fixed or even moves slightly upwards. In consequence, the sagittal suture approaches the promontory (*v.* Fig. 187). The greater the obstruction to the descent of the posterior parietal bone, the further does this rotation continue, and in cases of marked obstruction the sagittal suture may reach the promontory, and the ear be found behind the symphysis (ear presentation). Consequently, a very reliable estimate of the degree of obstruction present may be made by noting the position of the sagittal suture (Litzmann). If the obstruction is not too great for the head to pass the brim, the anterior parietal bone becomes fixed behind the symphysis, and the head rotating round it, the posterior parietal bone is squeezed past the promontory. At the same time the head, as a whole, glides transversely in the direction of the occiput, and so brings a diameter between the bi-parietal and the bi-temporal diameters into the conjugate. In consequence of these two movements, and of the crushing of the parietal bone against the promontory, a deep dint may occur in the head where it was in contact with the promontory. As soon as the parietal bone has passed the promontory, the remainder of the mechanism of delivery is as usual.

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[*] 'Die Lehre vom Mechanismus der Geburt' Mainz, 1838

The causes of posterior asynclitism, in cases in which there is no disproportion between the size of the head and of the pelvis, are to be found in a pendulous abdomen and latero-flexion of the body of the fœtus. In a pendulous abdomen the axis of the uterus lies considerably in front of the axis of the brim, and, consequently, the head, instead of being driven down into the pelvis, is driven more or less in the direction of the promontory. As a result, the anterior parietal bone presents, owing to the horizontal position of the fœtus and to the obstruction offered to the descent of the posterior parietal bone. Latero-flexion of the body of the fœtus, in such a direction as to carry the head more posteriorly than usual, also tends to produce this condition.

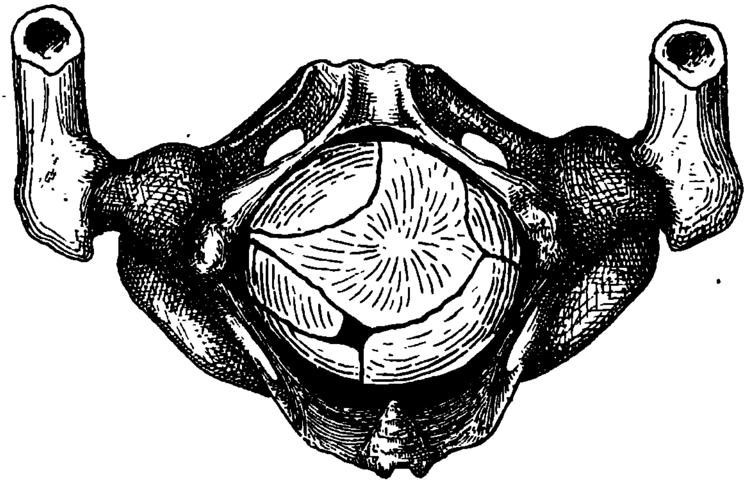

FIG. 187.—POSTERIOR ASYNCLITISM, OR NAEGELE'S OBLIQUITY. The head presenting at the brim, as felt by vaginal examination.

Anterior Asynclitism.—Anterior asynclitism of the head—Litzmann's obliquity,* or reversed Naegele's obliquity, or posterior parietal presentation—is a rarer abnormality of labour than the previous condition. It is met with in both contracted and non-contracted pelves, and is probably more frequently met with in association with a normal pelvis than is posterior asynclitism (Winckel). It is difficult to determine its precise cause, but, in all probability, alterations in the normal relation between the uterus and of the pelvic brim are largely concerned in its production. If the axis of the uterus lies posterior to the axis of the pelvic brim, then the uterine contractions drive the head more forcibly against the symphysis than is normally the case. As a result, the descent of the anterior parietal bone is obstructed and the posterior becomes the presenting part. This condition may also occur in flattened pelves and in cases of latero-flexion

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* 'Ueber die hintere Scheitelbeineinstellung,' *Archiv f. Gyn.*, 1871, ii 433-440.

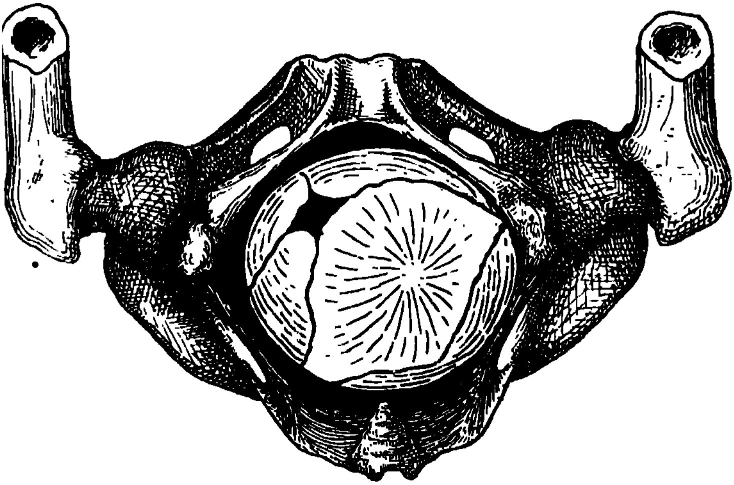

FIG. 188.—ANTERIOR ASYNCLITISM, OR LITZMANN'S OBLIQUITY.
The head presenting at the brim, as felt by vaginal examination.

of the body of the fœtus in which the head is carried more anteriorly than normal. If the obstruction to the descent of the anterior parietal bone is so great as to prevent the passage of the head through the brim, the head continues to rotate on its antero-posterior diameter, and, consequently, the sagittal suture approaches nearer and nearer to the symphysis (*v.* Fig. 188). If this rotation continues long enough, the ear may present. The manner in which the head passes through the brim in a flat pelvis with this obliquity present is thus described by Herman :—' The pains drive down the anterior parietal bone, and, as it descends, the posterior lying parietal bone moves up, and then first the anterior parietal eminence passes the brim, then the posterior. Sometimes the side of the head opposite the promontory remains fixed, and the head rotates round this point as when it is in the anterior parietal position it rotates round the symphysis. But this only happens when the fœtal head is small and soft, so that it becomes indented instead of moving up.'* Anterior asynclitism of the head is always unfavourable to delivery, and in this way

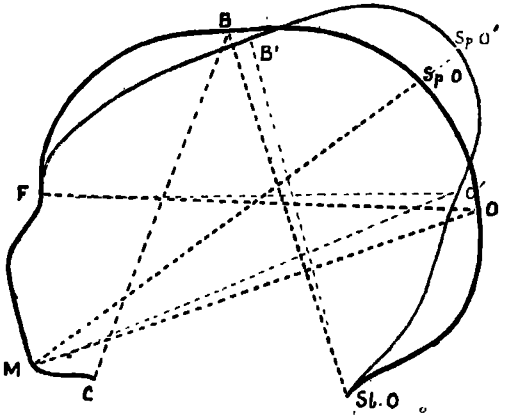

FIG. 189.—THE MOULDING OF THE HEAD IN VERTEX PRESENTATION. The black outline shows the unmoulded, the red the moulded, head. (Budin.)

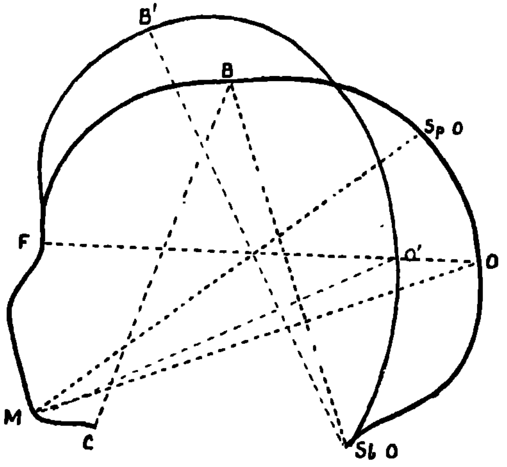

FIG. 190.—THE USUAL MOULDING OF THE HEAD IN OCCIPITO-POSTERIOR POSITIONS OF THE VERTEX. (Galabin.)

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* *Op. cit.*, p. 185.

contrasts with posterior asynclitism, which is the most favourable mechanism of delivery in cases of flat pelvis.

Moulding.—The pressure to which the head is subjected during labour in consequence of the rigidity of the pelvis, results, in the case of a vertex presentation, in a considerable change in the form of the head. The occipito-frontal, the sub-occipito-bregmatic, and the bi-parietal diameters are all diminished, while the necessary compensatory elongation is obtained by a considerable increase in the supra-occipito-mental diameter. These alterations produce a marked effect upon the shape of the head, which is well shown in the accompanying diagram (*v.* Fig. 189). In cases of occipito-posterior rotation of the head, the moulding which takes place is somewhat different. It will be remembered that we described two methods in which the head could be born in this position. In the first, the root of the nose comes to lie under the symphysis, the sinciput is born first, then the vertex and occiput by flexion, and, finally, the face by extension. In this case the moulding of the head results in a marked diminution in the occipito-frontal and occipito-mental diameters, and a compensatory increase in the sub-occipito-bregmatic and in the cervico-bregmatic diameters (*v.* Fig. 190). In the second method of delivery, extreme flexion brings the forehead behind the symphysis; the occiput is first born by a slight increase of flexion, and the remainder of the head by extension. In such cases, the moulding of the head results in the production of a more marked degree of the same changes as occur in the normal vertex mechanism. The sub-occipito-bregmatic and the sub-occipito-frontal diameters are very much diminished, while the compensatory elongation of the supra-occipito-mental diameter is considerable.

The caput succedaneum, as a rule, first forms about the centre of the interparietal suture, and to the right or left of it according as the fœtus lies in a first or second position. As flexion and rotation occur, and the head descends, the caput moves backwards along the edge of the suture in the direction of the posterior fontanelle. In cases of occipito-posterior rotation of the head, the caput forms over the anterior superior angle of one or other parietal bone, according to the position in which the fœtus lies, and does not materially change its position during expulsion. As the caput, as a general rule, is situated more on the right side of the head in a first position and on the left side in a second position, it is usually possible to determine after expulsion of the fœtus the position in which it lay, and so to correct our original diagnosis.

CHAPTER IV

THE MANAGEMENT OF NORMAL LABOUR

Preparations for Labour—Posture in Obstetrical Practice; The Side Position, The Dorsal Position, The Knee-chest Position, Trendelenburg's Position, Walcher's Position The Management of the First Stage—The Management of the Second Stage, The Treatment of Occipito-posterior Positions of the Head—The Management of the Third Stage—The Management of the Infant—Anæsthesia during Labour—The Use of Ergot.

NORMAL labour consists in the child presenting by its vertex, and in the uterine contractions coming on and following one another in such a manner that the child is born and labour is ended without artificial aid or any complications within twenty-four hours. About 90 per cent. of all labours follow such a course, and, consequently, it is of the greatest importance that the obstetrician should understand the phenomena and management of normal labour. The golden rule to remember is that so long as events are following a normal course the patient requires but little assistance. The obstetrician must be capable of detecting any deviation from the normal course of events and of remedying it, and he must also be capable of refraining from interference so long as their course remains normal. All internal manipulations impart an extra element of risk to the labour, and hence they must only be made to guard against or remove greater risks.

Preparation for Labour.—The room in which the patient is to be confined, and in which she must subsequently pass the puerperium, should be, whenever possible, of good size, well ventilated, warm, well-lit, and free from draughts and from unnecessary furniture. The patient's bed must be so placed that plenty of light may fall on it, especially on the right-hand side. It should stand on a large piece of linoleum in order to prevent blood or other fluid from falling on the carpet. The bedstead should be a single one, made of metal, and with a wire mattress, on which a firm hair mattress is placed. If possible, it is advisable that during the confinement boards should be placed between the hair mattress and the wire one in order to make the former as steady as possible, as it is most difficult to maintain the patient in either the lateral or the cross-bed position if the edge of the bed sags beneath her weight.

These boards can be removed as soon as labour is over. The bed itself should be made in the following manner from below upwards:—(1) The mattress; (2) A large mackintosh completely covering the mattress and turned in beneath it; (3) An under blanket; (4) The under sheet and bolster; (5) A small mackintosh enclosed in a draw-sheet, of sufficient size to reach from the middle of the patient's back to the knees; (6) A pillow; (7) A top sheet and the necessary number of blankets. The draw-sheet and contained mackintosh should hang over the side of the bed in such a manner as to form a valance. The other essentials in the room are a large jug which will hold about a gallon and a half; a stand on which it can be placed and which will raise it about two feet above the bed of the patient; four basins—one in which to wash the hands, one for the antiseptic, one in which to keep cotton-wool wipes for the patient, and one in which to place any instruments that may be required; plenty of hot and cold water, a small bath in which the infant can be washed; a large bath or tin to place beneath the bed, if douching is required; lastly, a fire on which a kettle can be boiled should be within reach, in cold weather it will be in the patient's room. The jugs for the douche, and all the basins, must be carefully scrubbed with soap and water before use. The garments for the infant, and the patient's binder, etc., should be hung near the fire so that they may be warm when required. The sanitary towel or wool pad which it is intended to apply over the vulva after delivery, and the ligatures with which it is intended to tie the cord should be placed at the commencement of labour in a basin in 1 in 500 corrosive sublimate or other disinfectant. By so doing, they are sterilised ready for use when required.

The patient should be clad in warm, light, and loose garments which can readily be removed when necessary. During the first stage, she may wear her usual underclothing covered by a dressing-gown. During the second stage, when she is in bed, a short night-gown and a flannel wrapper are best. A clean night-gown must be ready for use after delivery.

It is advisable in all cases to administer a purgative as soon as the first symptoms of labour appear. For this purpose castor-oil, liquorice-powder, or cascara sagrada may be used, and should be followed by an enema as soon as labour has well set in. In this way the rectum is emptied, and all soiling of the parts by the forcing out of fæces during the second stage is avoided. The patient should pass water at frequent intervals during labour, and if she is unable to do so a catheter must be passed. It is also a good thing for the patient to have a warm bath during the premonitory stage, but the nurse must be in the room at the time to assist her. Cases of precipitate labour, in which the child was born unexpectedly while the patient was in a bath, have been recorded. In all cases, the external genitals must be well washed by the nurse with soap and water and then bathed with an unirritating antiseptic. For this purpose lysol is most suitable, but it must not be used too strong or it will cause smarting. The use of corrosive sublimate for this purpose during labour is contra-indicated, as it constringes the parts, and so makes them prone to lacerate. Vaginal douches should not be administered in cases of normal labour, unless they are indicated by the presence of a pathological condition of the genital canal.

POSTURE IN OBSTETRICAL PRACTICE.—There are several different postures or positions in which the patient can be placed during labour, and which offer special advantages under particular circumstances. The principal of these various positions are as follows:—

(1) The side position. (2) The cross-bed position. (3) The knee-breast position. (4) Trendelenburg's position. (5) Walcher's position.

The Side Position.—The choice of the side on which the patient shall lie is governed by the conditions present. In these countries, unless there is any special indication for any other position, the patient lies during the second stage on the left side, her buttocks projecting over the edge of the bed, and her knees slightly drawn up. She is then in the most suitable position for a vaginal examination, and during delivery the operator, standing behind her at the level of the sacrum and facing her feet, has his right hand free to undertake the necessary manœuvres for the preservation of the perinæum. On the other hand, anomalies in the mode of presentation of the head at the brim or of the presentation may necessitate in some cases a change of position, as the side on which the patient lies influences to some extent the relation of the presenting part to the pelvic brim and the course of internal rotation. When the patient lies on one side, the body of the fœtus falls over to the same side, and the presenting part, if not fixed, rises towards the opposite side. Accordingly, if the fœtus is lying in an oblique position with its presenting pole in one iliac fossa instead of over the brim, by placing the patient on the side at which the presenting pole lies, we help the latter to rise out of that position and to come to lie over the brim. Similarly, if the presenting part is in the brim, and if we desire to lessen its pressure against one side of the brim, as in the case of a prolapse or presentation of the cord, we place the patient on the side at which the prolapsed cord lies, in order that the presenting part may rise slightly towards the opposite side. Furthermore, it is advisable that in a vertex presentation the patient should lie on the side to which the occiput is turned, and in a face presentation on the side to which the chin is turned, as this is said to favour their anterior rotation.

The Dorsal Position.—In the dorsal position, the patient lies on her back, the head and shoulders low, the hips slightly raised, and the lower limbs drawn up and separated, so that the heels rest firmly upon the bed near the thighs. The dorsal position is usually adopted in preference to the lateral position, on the Continent and in America, during the delivery of the infant. Its chief advantage is that auscultation can be more readily performed at any moment without changing the position of the patient—an important consideration during the expulsion of the fœtus. Whatever may be its merits in the second stage, there can be no doubt that—as will be presently seen—it is the most advantageous position in which to place the patient during the third stage. In the dorsal cross-bed position, the patient lies on her back across the bed, with her buttocks projecting over the edge (*v.* Fig. 191), and her legs supported by an assistant at each side, or resting on specially made leg-rests. It is the position usually adopted in all obstetrical operations, save, perhaps, the application of the forceps.

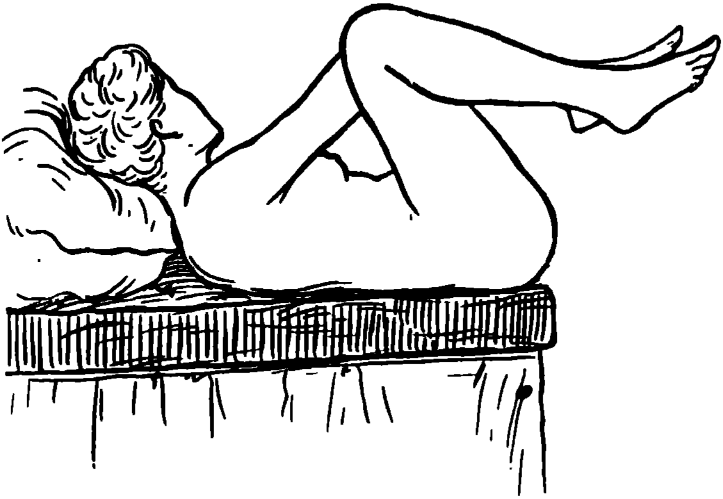

FIG. 191.—THE DORSAL CROSS-BED POSITION.

The Knee-Chest Position.—In the knee-chest, or knee-breast, position, the patient kneels in bed, and then bends forward until her chest comes in contact with the bed (*v.* Fig. 192). By so doing her body forms an inclined plane—the pelvic end being the highest, and, in consequence, the effect of gravity is to cause the abdominal contents to drop towards the diaphragm, and the uterine contents to fall towards the fundus. The position is of use in obstetrical practice for two purposes:—first, to assist efforts at the reduction of a retroverted pregnant uterus, and, secondly, to diminish as far as possible the force with which the presenting part presses against the pelvic brim. It will be readily understood that, in the condition known as prolapse or presentation of the cord, the fœtus runs a considerable risk of asphyxiation in consequence of nipping of the cord between the presenting part and the pelvic brim, and that anything that lessens the pressure of the presenting part against the brim will diminish this risk. If the patient is placed in the knee-chest position, and if the presenting part is not fixed, the latter will fall away from the brim and pressure upon the cord will temporarily cease.

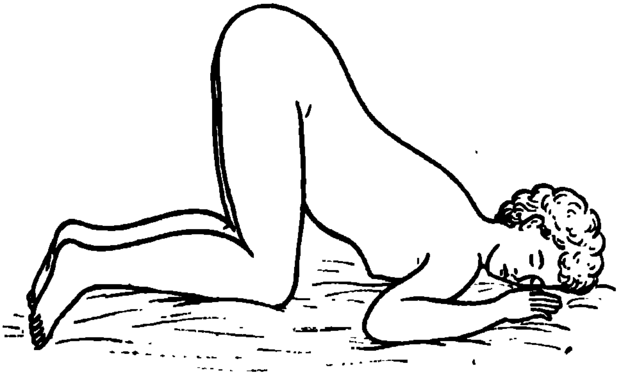

FIG. 192.—THE KNEE-CHEST POSITION.

Trendelenburg's Position. — In Trendelenburg's position, the patient lies on her back, with the hips considerably raised above the level of the remainder of the body. The body thus forms an inclined plane, as in the knee-chest position, but with the difference that in the latter position the back of the patient was uppermost, while in Trendelenburg's position the abdomen is uppermost. This position is usually adopted in operations on the pelvic organs, and is obtained by placing the patient on an

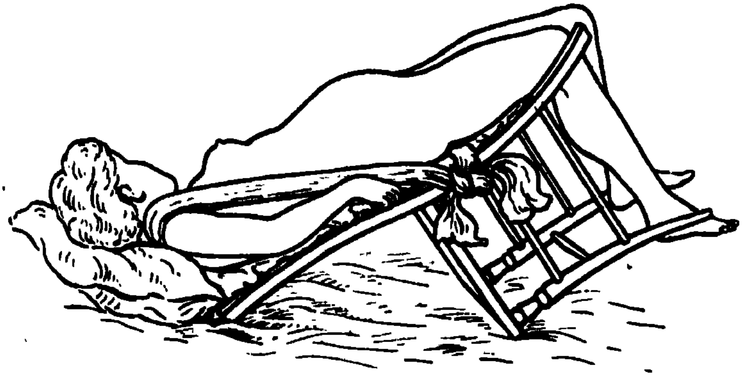

FIG. 193.—AN EXTEMPORISED TRENDELENBURG'S POSITION

operating-table, which can be inclined to the required angle. It may also be used as a substitute for the knee-chest position, than which it is more comfortable, in cases of prolapse of the cord. As in such cases the patient is usually in bed, an extemporary method of maintaining her in the required position must be improvised. A simple method of doing so consists in laying a square kitchen chair on its face along the bed, the top back-rail towards the patient (*v.* Fig. 193). The back of this is then well padded with cushions, and the patient placed on it in such a manner that her hips are the highest part of the body.

Walcher's Position.—In Walcher's position, the patient lies on her back on a table or firm bed in such a manner that the sacrum rests on the edge, while her legs hang down freely without support (*v.* Fig. 194). The position is named after Walcher, who originally drew attention* to its advantages in certain cases. It results in a downward rotation of the pelvic girdle round the sacro-iliac joints and in the consequent movement of the symphysis pubis away from the promontory, and by its means a temporary increase is obtained in the length of the true conjugate, and a corresponding diminution in the length of the antero-posterior diameter of the outlet. According to Walcher, this increase is from one-third to half an inch (0·85 to 1·3 cms.). The cause of the rotation of the pelvic girdle is to be found in the weight of the hanging limbs which weight is transmitted to the innominate bones through the Y-shaped ligaments. The movement is akin to

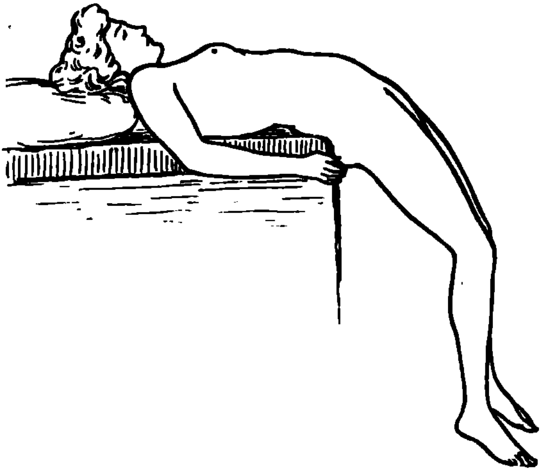

FIG 194.—WALCHER'S POSITION.

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* 'Die Conjugata eines engen Beckens ist Keine Konstante Grösse,' etc., *Centralb. f. Gyn.*, 1889, pp 892, 893.

that described by Matthews Duncan under the term 'nutation of the sacrum,' and only differs from the latter in that in sacral nutation the sacrum is said to alter its position with regard to the pelvic girdle, while in Walcher's position the pelvic girdle alters its position with regard to the sacrum. Walcher's position is of considerable value in all cases in which, in consequence of a slight

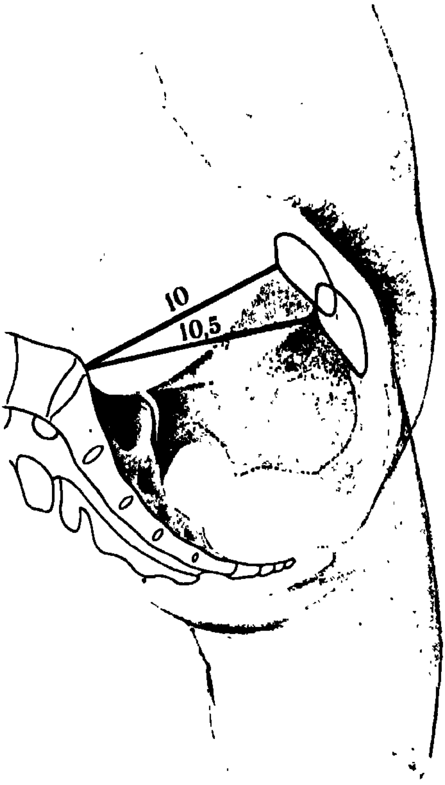

FIG 195.—DIAGRAM SHOWING THE EFFECT OF WALCHER'S POSITION ON THE LENGTH OF THE TRUE CONJUGATE

10, Length of C.V. in centimetres when the patient is in the lithotomy position; 10 5, length when in Walcher's position. (Bumm.)

disproportion between the head and the antero-posterior diameters of the brim, a temporary increase in the length of the latter is required. It, however, possesses the drawback that the patient can only be kept in it for a short time, in consequence of the extreme discomfort which it causes. The available time is, however, long enough to permit of the delivery of the fore-coming head with forceps, or of the after-coming head with the fingers.

The Management of the First Stage.--The obstetrician's duties during the first stage of labour are not many. He must first determine the presentation and position of the fœtus, the state of the genital passages, and the general condition of the patient. If the results of his examination show that the case is so far in every way normal, his second duty is to facilitate the phenomena of the stage so far as possible.

We have already described how the diagnosis of the conditions of labour is to be made. The obstetrician should first obtain from the appearance of the patient as much information as possible regarding her condition, general health, etc. He should count the pulse and note its strength, and, if necessary, take the temperature and examine the heart and lungs. He should then carefully palpate the abdomen of the patient, and next, after thoroughly disinfecting his hands, he should make a vaginal examination. Finally, he should auscultate the fœtal heart, in order to determine the condition of the fœtus.

His next duty consists in facilitating the normal and regular occurrence of the phenomena of the stage. The main phenomena of the first stage are the taking up and the dilatation of the cervix and the engagement of the fœtal head in the pelvic brim, if this has not already occurred. Dilatation of the cervix can be facilitated by inducing the patient to walk about, or to sit rather than to lie down, and by preserving the membranes from premature rupture. The uterine contractions of the first stage act more advantageously when the patient is in an erect posture, as the action of gravity increases the downward pressure of the ovum. In this matter, patients, as a rule, require little urging, as they are more comfortable whilst walking about than when in bed. Premature rupture of the membranes cannot always be prevented, as the time at which this occurrence takes place usually depends on the adaptability of the presenting part to the lower uterine segment. It can, however, in some cases be warded off by preventing 'bearing-down' efforts on the part of the patient, and by keeping her in bed during the first stage in all cases in which the membranes protrude unduly into the vagina during a contraction of the uterus. It is unnecessary to remark that premature rupture may sometimes be the result of a maladroit vaginal examination. As soon as the uterine orifice is completely dilated the membranes are no longer required, and, if they do not rupture spontaneously, they may be artificially ruptured. This can be done by cutting them through by means of a scratching movement of the finger-nail, or preferably by puncturing them. For the latter purpose, the sterilised stilette of a catheter is suitable, and is usually at hand.

The engagement of the fœtal head can best be assisted by seeing that the axis of the uterus and of the brim as nearly as possible coincide, and by removing any obstacle to the descent of the head. As a rule, the axis of the uterus tends to fall in front of the axis of the brim, particularly in multiparæ, owing to the lax condition of the uterine wall. It may also incline to one or other side. The best means of correcting any such deviation consists in pinning a binder round the abdomen in such a manner as to lift the uterus upwards, and to press it in the required direction. In a normal case, the only obstruction which may be offered to the descent of the head is a full bladder or rectum, either of which conditions can easily be removed.

Abstention from unnecessary interference is essential throughout the whole of labour. In the first stage, the amount of interference which is necessary in a normal case is extremely small. Once the obstetrician has made his diagnosis of the nature of the case, and has assured himself that all is normal, and has given the necessary directions to the nurse and advice to the patient, the shorter time he remains in the patient's room the better for her. There is nothing so bad for a patient as a fussy medical attendant or nurse, particularly during the first stage, as her sufferings then are not so great as to save her from being worried by trifles. Repeated vaginal examinations are not only unnecessary, but harmful; the preliminary examination over, another should not be made until the commencement of the second stage, unless the first stage is unduly prolonged. Once the obstetrician has taken over the management of the case, all vaginal examination by the nurse must be strictly forbidden. Fortunately, in the case of the properly trained modern nurse such a precaution is seldom necessary, as she will herself appreciate the necessity for non-interference. In the case of the older nurses, who considered that it was part of their duty to follow the entire labour with the finger in the vagina and to assist in the dilatation of the os, the difficulty of preventing them from so doing was considerable.

MANAGEMENT OF THE SECOND STAGE. — The duties of the obstetrician during the second stage are more important and greater in extent, although, as before, they fall under two heads. He has to determine that labour is proceeding in a normal manner, and to facilitate the phenomena of the stage.

To determine that labour is proceeding in a normal manner, the obstetrician must carefully watch the appearance of the patient, the condition of her pulse and temperature, the character of the uterine contractions and their effect upon the uterus, and the mechanism of the descent of the head. One vaginal examination is all that is necessary during this stage, and in many cases even it can be dispensed with. It should be made as soon after the rupture of the membranes as possible, in order to determine whether a fœtal limb or the cord has prolapsed during the escape of the liquor amnii. In cases in which the first vaginal examination showed that the head was fixed in the pelvis and filled the lower uterine segment, this second examination need not be made, as under these circumstances it is impossible that any prolapse should occur. If the second stage is unduly prolonged, it will probably be necessary to make a third examination in order to determine the cause of the delay.

The principal phenomenon of the second stage is the expulsion of the fœtus. During the first part of this process—that is, until the fœtal head appears at the vulva, the obstetrician does not need to give any active assistance. The patient is kept in bed, as in this position she can best assist the uterine contractions by voluntary bearing-down efforts. These efforts are now encouraged, and, to enable her to make them with greater effect, a towel is tied to the foot or head of the bedstead in such a manner that she can take it in her hands and pull upon it during a bearing-down effort. If an occipito-posterior position of the head has been diagnosed, we may encourage forward rotation of the occiput by pressing up the forehead with the fingers in the vagina during a contraction, and so increasing flexion. In all cases, the patient should lie on the side to which the occiput is directed, as this encourages its anterior rotation.

As soon as the fœtal head appears at the vulva, the assistance rendered by the obstetrician must become more active, and he must prepare to assist the birth of the fœtus and to prevent the laceration of the perinæum. Numerous methods have been recommended for preventing laceration of the perinæum; but some of these, instead of being of value, perhaps actually predispose to rupture. In whatever method is adopted, the following objects must be kept in view:—

(1) *The Promotion of the Relaxation and Dilatability of the Parts.*—We have seen already that the vagina and perinæum obtain their power of extreme dilatation during labour mainly from a serous infiltration which softens and relaxes their tissues. We cannot, perhaps, very materially increase the amount of this transudation, but we can at all events avoid lessening it. All methods which aim at the direct support of the perinæum have a prejudicial effect, inasmuch as they prevent this transudation by squeezing the perinæum between the supporting hand and the descending head, and so diminishing the blood-supply. All astringent antiseptics, such as corrosive sublimate, have a somewhat similar effect, and in addition corrosive sublimate increases the friction between the presenting part and the mucous membrane, and so increases the strain on the perinæal tissues. We can, perhaps, increase the dilatibility of the perinæum to a slight extent by bathing the parts constantly with hot water to which an antiseptic such as lysol has been added, as the soap in the latter acts as a lubricant and diminishes friction.

(2) *Maintenance of Flexion of the Head.*—The accompanying diagrams (*v.* Figs. 196, 197) show the necessity for the maintenance of flexion until the lowest possible portion of the occipital bone lies beneath the symphysis. If the superior portion of the occipital bone engages beneath the symphysis, then, as

the head rotates round this point during extension, a diameter approximately corresponding with the occipito-frontal must

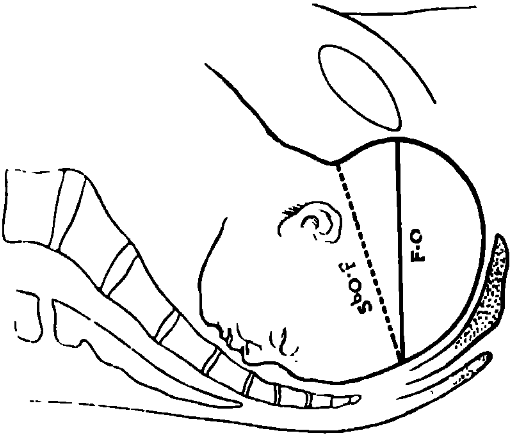

FIG. 196. DIAGRAM SHOWING THE MANNER IN WHICH THE HEAD OUGHT NOT TO PASS THROUGH THE VULVAR ORIFICE.

The longer occipito frontal diameter distends the perinæum.

distend the vaginal orifice. If, on the other hand, a point on the occipital bone below the occipital prominence fixes behind

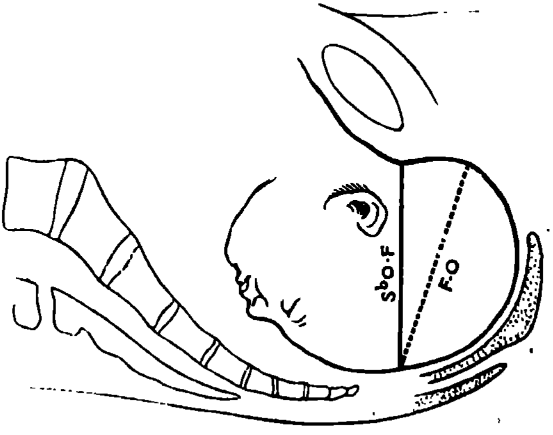

FIG. 197. DIAGRAM SHOWING THE MANNER IN WHICH THE HEAD OUGHT TO PASS THROUGH THE VULVAR ORIFICE.

Flexion is maintained, and the short sub-occipito-frontal diameter distends the perinæum.

the symphysis, the sub-occipito-frontal diameter will alone have to distend the vaginal orifice—that is to say, a diameter of four inches instead of one of four and a half inches. The method of maintaining flexion will be described presently.

(3) *Delivery between the Contractions.*—If the head is expelled by a uterine contraction at a time when the patient is straining and bearing down forcibly, the danger of perinæal laceration is greatly increased, as is the difficulty of bringing out the head in the most suitable position. If, on the other hand, we can prevent the head from coming out during a contraction, we can deliver it by expression from behind the anus assisted by the voluntary efforts of the woman as soon as the contraction is over. It is not, however, always possible to retard expulsion, but we can, at all events, diminish the force which is driving the head downwards. As soon as the birth of the head appears imminent, take away the towel, or whatever it may be, upon which the woman is pulling, and as soon as a contraction ensues, desire her to take deep breaths or to cry out, as by so doing she prevents herself from bearing down. Then, as soon as the contraction has passed off, endeavour to express the head in the manner which we are about to describe, and, if further help is required, desire the patient to strain down.

FIG. 198. —THE INDIRECT METHOD OF PRESERVING THE PERINÆUM.

The heel of the right hand pushes the head forward by pressure applied between the anus and the coccyx, and the fingers of the left hand endeavour to draw the head forward.

Accordingly—to recapitulate, a method of preserving the perinæum to be satisfactory must not entail direct pressure upon the perinæum, must maintain flexion of the head as long as possible, and must enable us to deliver the head between the contractions.

The due performance of these objects will, we consider, be best ensured by the following method. The patient lies on her left side, her buttocks projecting beyond the edge of the bed, her legs drawn up, and separated by a pillow. The obstetrician, standing by the side of the legs at the level of the buttocks, passes the left hand over the abdomen of the patient, and brings it between the thighs from before backwards, in such a manner that the advancing head can be grasped by the fingers when required (*v.* Fig. 343). When a contraction occurs, the patient is told to cry out and not to strain. If by this means the force of the contraction is so weakened that the head is not expelled, so much the better. If, however, the contraction is strong enough to drive the head downwards, all we can do is to try to bring the latter down in the most favourable position, as it is inadvisable to endeavour to hold it back. With the fingers of the left hand applied to the scalp, endeavour to draw the head as far forwards into the arch of the pubis as possible, while with the heel of the right hand endeavour to press the head forwards, and at the same time to keep it in a position of flexion, until the occipital prominence, or a point below it, lies beneath the symphysis. Further pressure with the fingers of the right hand will then result in producing extension, during which the head will be born. The extent to which the head can be drawn forwards by means of the fingers of the left hand is of course very slight, until a sufficient part of the head has been born to afford a firm grip. The forward pressure of the right hand is applied, not on the perinæal body, but over the area bounded anteriorly by the anus, laterally by the tubera ischii, and posteriorly by the tip of the coccyx. When the head is distending the perinæum, its outline can readily be felt, and with a little practice we know exactly what part of the head we are pressing upon.

If we are able so to lessen the strength of the contraction that it does not expel the head, as soon as it is over we apply pressure behind the anus, as has been described. For such pressure to be effective the head must be sufficiently low down, otherwise our pressure will merely drive it back into the uterus. If we find, on applying pressure, that the head is not sufficiently low, we must wait until another contraction has occurred, and then try again. If the head is sufficiently low, but the resistance to its birth is too great to allow it to be expressed in this manner, the patient must be made to bear down slightly, and then, as a rule, the head can be delivered.

The direct method of supporting the perinæum differs essentially from the foregoing. The palm of the right hand is laid over the perinæum in such a manner that the concavity between the thumb and index finger corresponds to the posterior margin of the vaginal orifice. As the head distends the perinæum, the latter is supported and prevented from becoming overdistended, while, at the same time, the head is gently pressed in the direction of the symphysis. The objection to any such method is—as has been mentioned—that the natural mechanism by which the perinæum is rendered dilatable is hindered. Furthermore, the method is not of much practical value. We can prevent by pressure the perinæum from bulging downward any farther than we think fit, but we cannot prevent it from splitting down the middle in order to allow room for the advancing head, and this is in all probability what occurs when the perinæum is directly supported. Indeed, it is not improbable that rupture occurs in a greater percentage of cases than would be the case if the expulsion of the head was left to Nature. It is not difficult to understand why this should be so. Direct pressure upon the perinæum cannot increase its dilatability, nor can it diminish the diameters of the head, which must distend it. If the perinæal dilatability is not sufficient to allow room for the head to pass, the perinæum will rupture whether we support it or not. Consequently, there is no appreciable gain obtained from mere support. If, on the other hand, we support it too strongly, we perhaps prevent it from bulging downwards to that degree to which, if uninterfered with, it would have bulged without rupture, and in such cases the perinæum is compelled to rupture in order to allow the head to pass, even though its maximum amount of distension has not been reached. In short, the direct method has nothing to recommend it, and should not be adopted.

Several methods have been recommended, in the performance of which the fingers are introduced into the rectum. The 'manœuvre of Ritgen'* consists in passing the index and middle fingers into the rectum and making pressure upon the forehead of the fœtus, while at the same time the thumb close to the fourchette controls the part of the head that is already born. It is obvious that by this means we are applying a pressure to the head which can be just as well applied externally over the ano-coccygeal space, as we have described, and this, too, without soiling the fingers. Goodell† recommended hooking two fingers into the rectum and drawing it forward, with the object of lengthening the perinæum, while at the same time the thumb controls the advance of the head All methods in which the fingers are introduced into the rectum are objectionable, while Goodell's method in particular probably tends to cause laceration of the rectal mucous membrane.

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* 'Ueber ein Dammschutzverfahren,' *Monatss f. Geburts.*, 1855, vi 321-347.

† 'A Critical Inquiry into the Management of the Perinæum during Labour,' *Amer. Journ. of Med. Sciences*, 1871, vol lxi., pp. 53-79

In some cases in which, owing to the small size of the vaginal orifice, serious laceration appears to be certain to occur, it is advisable to perform the operation known as episiotomy—that is, to incise the perinæum in such a manner as to increase the size of the vaginal orifice. This procedure was first recommended by Fielding Ould[*] in 1742, and since then has had intervals of popularity and unpopularity. There is no doubt that the clean-cut incision made by scissors will in some cases be smaller, and will heal more readily than the large laceration which might otherwise result, and, further, that such an incision may save the involvement of the rectal wall or sphincter ani. It is, however, difficult to foretell before a laceration occurs its probable course and extent, and, consequently, it is difficult to know what cases are suitable for episiotomy and what cases are not. It is, however, always well to have a stout pair of blunt-pointed scissors at hand, and if the degree of dilatation of the perinæum is excessive before the large diameters of the head distend it, episiotomy may be performed. The method of doing so will be subsequently described.

We wish to impress on our readers the necessity of having an uninterrupted view of the expulsion of the fœtus and the dilatation of the perinæum. It ought not to be necessary to do so at the present day, but, in view of the fact that some text-books appear to imply that it is not always necessary to have such a view, we think it well to insist upon the point. Presumably, when non-exposure of the parts is adopted, it is done with the object of sparing the feelings of the patient, but, during the expulsion of the fœtus, the patient is far too much occupied by her sufferings to notice what is done, and, moreover, no sensible patient will object to a precaution taken for her own good, if the necessity for it is made clear to her. The patient's sensibilities have in the past been too frequently considered to the detriment of her physical condition. Catheters have been passed by touch, and cystitis set up. Vaginal examinations have been made under the clothes—the fingers being guided into the vagina by passing them up the back of the thighs to the buttock, and then over the perinæum and fourchette to the entrance of the vagina, and septic infection has resulted. The fœtus has been delivered under the bedclothes, and the perinæum torn into the rectum without the medical attendant being any the wiser. Such practices are now, we hope, abandoned for ever. At one time they were the sign of the skilful obstetrician; they are now the sign of the ignorant one.

As soon as the head has been delivered, the next duty of the obstetrician is to ascertain that the cord is not twisted round the neck. To do this, he slips one or two fingers into the vagina until the neck is reached, and feels carefully in all directions. If the cord is round the neck, it must be set free in some manner, as otherwise it may be so short as to prevent the birth of the fœtus.

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[*] 'A Treatise on Midwifery,' p. 145.

The usual method of doing this consists in drawing down a loop and slipping it over the head. If there is a second loop, it must be drawn down in a similar manner. In some cases, the cord may be so tightly round the neck that it is impossible to draw it down, and, as immediate delivery of the fœtus is necessary, some other method of freeing it must be adopted. Accordingly, in such cases make the patient bear down, or apply pressure over the fundus of the uterus, and as the fœtus descends slip the cord first over one shoulder and then over the other. The result of this is that the fœtus descends through the loop in the cord. If the portion of cord round the neck is so short as to prevent even this manœuvre, the loop must be divided with scissors, and the fœtus quickly delivered by pressure upon the fundus and traction on the head. The fœtal end of the cord is then immediately ligated. It is quite unnecessary to ligate the cord before it is divided, as the compression to which it is subjected during the expulsion of the fœtus will prevent any hæmorrhage from occurring.

If the cord is not round the neck, or, if being so at first, it is set free and is found to be pulsating, it is not necessary to unduly hurry the expulsion of the trunk. Usually, in half a minute or so after the birth of the head, a uterine contraction occurs and drives the shoulders down. As they descend, lift the head forwards between the thighs in the direction of the mother's abdomen, in order to bring the posterior shoulder over the perinæum. Then draw the head slightly backwards, in order to bring the anterior shoulder from behind the symphysis. In this way both shoulders are delivered, and by again drawing the head and shoulders forward the rest of the body follows. The left hand on the fundus should follow down the descending uterus, and note that it is contracting properly. If it is necessary to expedite the expulsion of the shoulders for any reason, always endeavour to do so first by pressure over the fundus, and if this fails then apply traction to the head. Pressure applied over the fundus has the same effect as have the contractions of the uterus, and does not in any way interfere with the ordinary mechanism of delivery. Traction applied to the head before internal rotation of the shoulders has occurred may, on the other hand, interfere with the ordinary mechanism, and lead to the impaction of the shoulders in the pelvis. If we are finally obliged to pull upon the head, we must at the same time rotate it gently in whatever direction rotation of the shoulders is occurring. It is advisable to pass the fingers into the vagina along the child's body to ascertain the position of the shoulders, and if either axilla has descended sufficiently low to be within reach, to hook a finger into it and apply traction. Even a normal case may sometimes require such assistance, but, if a case cannot be delivered by this means, it shows that it has ceased to be normal, and that the shoulders have become impacted. The treatment of such a condition will be referred to in its proper place.

There is a question of practical importance which will occur to many regarding the management of the second stage, and that is, Is it necessary to adopt any special measures in the case of occipito-posterior positions of the vertex? As we have seen, in the large proportion of cases the occiput rotates anteriorly, while in others it rotates posteriorly and causes a corresponding delay in labour. In the first class of case any interference is unnecessary, but in cases in which posterior rotation is probable it is obvious that everything should be done to promote anterior rotation. Such an answer is not, however, of any practical value, as we cannot tell beforehand whether in a given case the occiput will rotate anteriorly or posteriorly. Before answering the question definitely, let us first see what are the various ways by which the position can be corrected. This can be done by one or other of the following methods, according to the circumstances of the case:—

Rotation of the Fœtus by External Manipulations.—This method is described by Herman.* It can be performed in all cases in which the membranes are unruptured and the head above the pelvic brim, and consists in rotating the body of the fœtus on its long axis by means of gentle pushing movements as in external version. The movements are made in such a direction that the anterior shoulder moves towards the opposite side of the pelvis to that at which it previously lay, and the back comes to lie anteriorly. Thus, if the fœtus originally lay in a first position with the back posteriorly, and its anterior shoulder at the anterior end of the right oblique diameter, this shoulder is pushed to the right until it lies at the anterior end of the left oblique diameter. The fœtus then lies in the first position with the back in front. The head should be held over the brim in this position until it becomes fixed, or, if the os is fully dilated, the membranes may be ruptured and a tight abdominal binder applied. In this way, the same end will be obtained.

The Production of Increased Flexion.—As we know, one of the most important causes of posterior rotation of the occiput is insufficient flexion, and consequently a very proper way of preventing the occurrence of posterior rotation is by increasing flexion. This can be done—at all events to a slight extent—at almost any stage of labour by passing two fingers into the vagina, and firmly, but without violence, pushing up the forehead during a uterine contraction. This procedure is repeated during several contractions, and as no increased resistance is offered to the descent of the occiput, the latter descends, and the degree of flexion is increased. Flexion can also be produced by pulling down the occiput instead of by pushing up the forehead. This procedure, however, necessitates the use of an instrument known as a vectis, which is not, as a rule, to be found in the armamentarium of the modern obstetrician. It has nothing particular to recommend it, and, consequently, need not be described.

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* 'Difficult Labour,' second edition, p. 9.

Rotation of the Head by Internal Manipulation.—This method is adopted by Tarnier,* by whom it was described, and is carried out as follows:—Pass into the vagina the index finger of whatever hand corresponds to the side towards which the anterior ear of the fœtus is directed. If the fœtus lies in the first position with the back behind, the right ear will be anterior and point towards the left side, consequently the right finger will be used. Pass this finger upwards beside the head until it lies behind the right ear, and then, keeping it fixed in this position, wait for a contraction and, as soon as this occurs, carry it steadily and firmly forwards along the back of the left pubic bone and past the symphysis until it reaches a corresponding position at the opposite side. In this way the head is rotated until the right ear, which originally lay at the anterior end of the right oblique diameter, has come to lie at the anterior end of the left oblique diameter. This manipulation is best performed at the end of the first stage or at the commencement of the second, and the attempt at rotation is made just as a contraction is about to occur. If the necessary amount of rotation has not been obtained by the time the contraction has ended, wait for the next contraction, keeping the head in the position it has reached by a slight pressure of the fingers, and then repeat the attempt. Internal rotation can also be produced by means of the forceps. This procedure was first described by Smellie,† to whom it gave 'great joy.' It is not, however, a practice which can be recommended, as it may lead to injuries of the head of the fœtus and of the maternal soft parts.

Rotation by Combined External and Internal Manipulation.—This method consists in passing one hand into the vagina and grasping the head internally with it, while the other hand, on the abdominal wall, lies over the anterior shoulder. Then, by internal rotation of the head assisted by pressure upon the anterior shoulder in the required direction, the occiput is brought anterior. If the shoulders follow the rotation of the head to the required extent, the head will remain in its new position; if the shoulders have not rotated, the head will slip back again into its former position.

We must now answer the question which we have asked. Is it necessary to correct every occipito-posterior position of the head by one of the foregoing methods? Most authorities will disagree in the answer. We consider that if the head is not fixed, and if the fœtus can be rotated by external manipulation, it is well to do so. If external manipulation fail we may, perhaps, endeavour to cause rotation by promoting flexion in the manner that has been described and by directing the patient to lie on the side to which the occiput is turned. Otherwise, the case may be left to Nature. Even if the occiput does rotate posteriorly, eventually, in most cases, labour will end naturally. If it is delayed, extraction with the forceps is not difficult.¹ Herman states, that, in cases in which prolonged traction had been made with the forceps without success, he has frequently succeeded in rotating the occiput forwards by combined external and internal manipulation, and has then easily effected delivery by the forceps.* Accordingly, in such cases, this procedure may be tried.

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* Ribemont-Dessaignes and Lepage, p. 398.

† 'Theory and Practice of Midwifery,' New Sydenham Society's edition, vol. ii, p. 339.

THE MANAGEMENT OF THE THIRD STAGE.—In a case of normal labour, the third stage is the one which requires the most careful attention on the part of the obstetrician. As we have already seen, the contractions of the uterus can, unaided, effect the expulsion of the fœtus, the detachment of the placenta, and the expulsion of the latter from the uterus; but they, as a rule, fail to bring about the expulsion of the placenta from the vagina within a reasonable time, owing, in all probability, to the artificial surroundings and position of the patient. Consequently, skilled aid is required to assist in the delivery of the after-birth. Further, the liability to hæmorrhage, as a result of the detachment of the after-birth, appears to be considerable amongst civilized races, and on this account also skilled assistance is very necessary during the third stage.

The duties of the obstetrician during the third stage consist in facilitating the detachment and expulsion of the placenta, and in preventing the occurrence of hæmorrhage. Clinically, we divide the third stage into two periods, in correspondence with the two stages in the expulsion of the after-birth. During the first period, the placenta is detached and expelled from the cavity of the uterus into the lower uterine segment or the vagina. During the second period the placenta is expelled from the lower uterine segment or vagina externally. During the first period, the duties of the obstetrician are to promote the contraction and retraction of the uterine fibre in order to bring about the detachment and expulsion of the placenta. During the second period, his duty is to still promote contraction and retraction, and, in addition, to expel the placenta from the vagina

As soon as the infant is born, the patient is turned from the lateral position on to her back, and the medical attendant places his hand upon the fundus of the uterus. He maintains the hand in this position during the entire stage, in order to note the occurrence of contraction and relaxation of the uterus, to promote contraction by gentle friction of the fundus, and to prevent the accumulation of clots in the cavity in cases in which the contractions are feeble or absent. He further notes by this means the rising of the uterus into the abdomen, an occurrence which shows that the placenta has been expelled. The hand must be so applied to the uterus that it covers the fundus completely—roofing it over as it were. If the hand is applied to the anterior surface of the uterus, the fundus may slip away above it, and

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* *Op. cit.*, p 13.

then the stimulation of the hand may cause the lower uterine segment to contract while the fundus remains in a more or less relaxed condition above. In this manner, irregular contractions of the uterus are set up, and these may result in the incarceration of the placenta or in the occurrence of post-partum hæmorrhage due to the accumulation of clots in the uterine cavity. Perhaps the best method of applying the hand consists in sinking its ulnar edge transversely into the abdomen just below the umbilicus, until it meets the resistance offered by the spinal column. The entire uterus is then below the palm of the hand.

The object of placing the patient in the dorsal position is obvious. In the first place, the obstetrician can, with far greater ease, 'control' the uterus, and, in the second place, the uterus tends to sink into the pelvis and so to occlude the dilated vagina. When, however, the patient is in the lateral position, the uterus tends to fall to one or other side and to draw the vagina upwards with it. Such a movement may cause a negative pressure inside the vagina and so facilitate the entrance of air.

We must now consider the management of the placenta. As we have seen, the contractions of the uterus will suffice to detach the placenta and to expel it into the vagina, and this will, as a rule, take place within a comparatively short period after the delivery of the fœtus. The further expulsion of the placenta is, however, a tedious process, and may take a considerable number of hours if left to the natural efforts alone. Moreover, the detachment and expulsion of the placenta from the uterus is a process which can really be only satisfactorily carried out by the natural mechanism. It must be remembered that not only has the placenta to be detached, but the mouths of large uterine bloodvessels have to be permanently closed in order that hæmorrhage from them may not occur. The closure of these vessels is mainly brought about by uterine retraction, and this process requires a little time and several contractions of the uterus to complete. If the placenta is detached by the forcible compression of the uterine walls from without, retraction may not at the time be complete, and hæmorrhage will result. If, on the contrary, its detachment is left to the natural efforts, we can be sure that, by the time it is completely detached, retraction will be complete. Further, it is all-important that the entire placenta should come away and that no fragments should be left adherent to the uterus. Unless the adhesions between the placenta and the uterus are pathologically dense, a normal amount of contraction and retraction will serve to completely break them down. If, however, we endeavour to break them down by forcible compression of the uterus from without, it is extremely probable that fragments of the placenta will be torn off and left in the uterus. The expulsion of the placenta from the vagina is quite another matter. There are no adhesions holding it in this position, and all that is needed to procure its expulsion is a sufficient expelling force. This force can be safely supplied by the obstetrician, and inasmuch as the natural mechanism by which the second stage of placental delivery is effected is a slow and tedious one, it is proper that in all cases the obstetrician should supply it. Accordingly, we see that, while the first period of the third stage should be left altogether to the natural efforts, in the second period the obstetrician may come to the assistance of Nature and complete the delivery of the placenta.

It may, however, be that, even in the first period, the natural efforts are not sufficient to effect the detachment of the placenta and its expulsion from the uterus, either owing to insufficient contractions of the uterus, to too dense adhesions between the placenta and the uterus, or to other cause. What is to be done in such cases? We cannot allow the third stage to last for an unduly long period; but when should we interfere? This question can be best answered in Credè's words:—'The uterus should expel the after-birth, and the sooner it does so after the expulsion of the fœtus the better. If it does not do so it must be made to do so, otherwise it may be too late and the dangers of retained placenta come into force.' To act in accordance with this dictate we must give the uterus a reasonable time in which to expel the placenta, and if it does not do so within this time we must help it to do so. In practice, we shall find that the uterus, as a rule, expels the placenta into the vagina within ten minutes of the birth of the infant, but that sometimes it may not have done so at the end of an hour. If it has not done so by that time there is little to be gained by waiting any longer, and steps must be taken to effect delivery.

There are three principal methods by which the delivery of the placenta, either from the uterus or the vagina, can be effected:—

(1) Expression from above.
(2) Manual removal.
(3) Traction upon the cord.

Expression.—The expression of the placenta by pressure on the fundus through the abdominal wall is the most satisfactory method of expelling the placenta in most cases in which it is retained in the uterus, and in all cases in which it is lying in the vagina. To perform it, we grasp the fundus through the abdominal wall, with one or both hands, during a contraction (*v.* Fig. 199). If we are compelled to express the placenta from the uterus, we compress the body of the uterus from above downwards, and from side to side, in such a manner as to squeeze out its contents into the vagina. Then, we press the uterus downwards and backwards in the direction of the last piece of the sacrum. By this means, the uterus is pressed downwards into the vagina and the placenta is driven out before it. If the placenta is already in the vagina, we omit the initial compression of the uterus.

The importance of this method of effecting the delivery of the placenta can hardly be overestimated, inasmuch as it enables us to entirely dispense in almost every case with internal manipulations, and thus to follow an important principle of modern obstetrics, which we have already enunciated—*i.e.*, the substitution, whenever possible, of external for internal manipulations. The origin of the method is therefore of interest. By some writers it is termed the 'Dublin method,' whilst by others, and they constitute the majority, it is termed Credè's method. We cannot here enter into the various reasons which make us consider that the former term is the more correct. It is sufficient to quote the words of Barnes:* 'This plan of causing the uterus to contract and expel the placenta by manual compression has, within the last few years, been introduced into Germany as a discovery by Dr. Credè, without a suspicion apparently that it had long been a familiar practice in this country.' It is insisted on with detail by Hardy and M'Clintock,† while M'Clintock, in his introduction to Smellie's 'Midwifery,'‡ alludes to the method as having 'been practised from time immemorial at the Dublin Lying-in Hospital.' The method first originated in Dublin, and

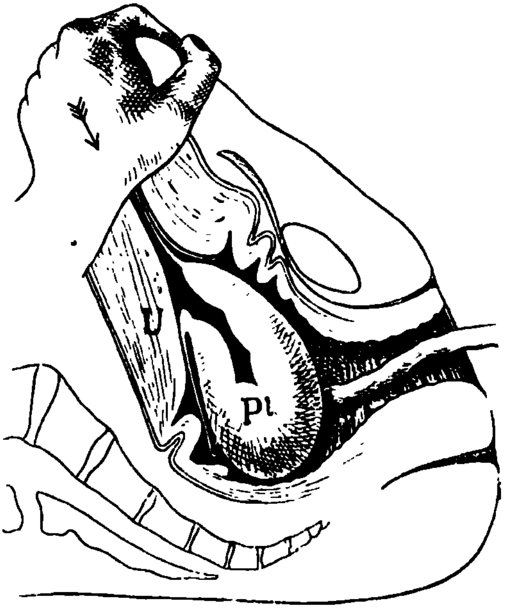

FIG. 199.—EXPRESSION OF THE PLACENTA BY THE DUBLIN METHOD
U, The uterus, Pl, the placenta

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* 'Obstetrical Operations,' third edition, p 522.
† 'Practical Observations on Midwifery,' p 221
‡ *Op. cit*, vol i., p 236.

the undoubted fact that Credè[*] discovered it for himself *de novo*, and did much to teach the medical profession its value, is no reason that its correct title should be abandoned.[†]

Manual Removal.—The placenta can be easily detached and removed from the uterus or vagina with the hand introduced into the genital passages. The objections to such a course of procedure in normal cases are, however, many and obvious. In the first place, such a procedure is directly opposed to the principle of modern obstetrics to which we have already referred—the substitution of external for internal manipulation. In the next place, as we have already said, detachment of the placenta is best performed by the uterus itself, and should always be left to that organ unless the latter fails to accomplish it. Further, manual removal causes more pain to the patient than does expression. Consequently, we may regard manual removal of the placenta as an operation which is only to be performed in cases in which expression fails, and so is never to be adopted in normal cases.

Traction upon the Cord.—The placenta can also be removed by traction upon the umbilical cord, but this method has little to recommend it, and possesses many disadvantages. In former days, it was extensively practised until its dangers came to be recognised. If strong traction is applied to the cord while the placenta is still adherent, one of several results may happen. First, the placenta may be pulled completely away, in which case no great harm is done provided that the detachment is not premature. Secondly, large portions of the placenta may be left behind, necessitating the introduction of the hand for their removal. Lastly, if the uterus is in a relaxed state when the traction is made, and if the adhesions between it and the placenta are dense, it may be inverted—that is to say, the fundus may be dragged downwards until it passes through the uterine orifice, the uterine body turning either in part or altogether inside out. This is a most serious accident, and will be referred to later. The removal of the placenta from the vagina by traction upon the cord is not open to such grave objection, and possesses the advantage over expression that it is less painful. However, it is difficult to be certain that the placenta is in the vagina, particularly if the medical attendant is inexperienced, and if he happens to make an error in diagnosis and tries to drag the placenta from the uterus, under the impression that he is removing it from the vagina, the accidents which have been just referred to may happen. Traction on the cord is, therefore, a practice with which it is better to entirely dispense.

Accordingly, we see that the most suitable manner in which to remove the placenta from the vagina in normal cases, or from the uterus in cases in which it is retained there, is by the Dublin method. If the Dublin method fails to procure its expulsion, we must then introduce the hand and remove the placenta, but this procedure is an obstetrical operation, and will be described under that heading.

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[*] 'Ueber die Zweckmässigste Methode der Entfernung der Nachgeburt' *Monatss. f. Geburt.*, 1861, vol. xvii., pp. 274-292.

[†] *Vide* also an article by the author.—'The Dublin Method of Effecting the Delivery of the Placenta' (*Trans Royal Acad Med in Ireland*, 1900, p. 305)

As we have already referred to the various physical signs which show that the placenta has passed from the uterus into the vagina, we need not again do so.

As the placenta emerges from the vagina, the nurse receives it in her hands, and supports it in order to prevent it falling suddenly on to the bed, and perhaps tearing away from the membranes which have not yet left the uterus. At the same time, she draws it gently downwards in such a manner as to cause the membranes to strip off the interior of the uterus and so to come away. It is most important that none of them should be left behind, and consequently this process must be carefully accomplished. If the membranes show any signs of breaking off short, the nurse should stop drawing on the placenta and take the membranes themselves in her fingers as high as she can reach, and pull them gently downwards for an inch or so. She should then take a fresh grip of them and draw down again, and so on until they have all come away. If a piece of membrane is left behind hanging from the uterine orifice it should be caught in a forceps as it is difficult to obtain a firm hold with the fingers, and pulled away, or, if that is impossible, broken off inside the orifice. In no case should a piece of membrane be allowed to remain hanging into the vagina, but, if a small portion is left behind in the uterus, it is of no great consequence, and it may be left there to come away in the lochia.

The placenta, with its adherent membranes, must then be placed upon a flat dish in order that we may thoroughly examine them with a view to determine whether any pieces have been left behind in the uterus. As the placenta is usually inverted into the membranes and the ovi-sac turned inside out, it is well to commence by turning the latter right again. The uterine surface of the placenta is then inspected in order to determine whether any cotyledons are missing. It frequently happens that there are deep gashes in the placental substance which have occurred during expulsion, and which, at first sight, appear to point to a portion being missing. If, however, the torn edges are pressed into place they will come together if the condition is merely due to a tear, while if a portion has been left behind there will still be a gap in the placental substance. In examining the membranes our attention must be directed to two points. First, we must ascertain whether both membranes are complete. We cannot be quite certain that small pieces have not been left behind, but if large pieces are missing we can always easily recognise the fact. Secondly, we must ascertain the number of openings in the membranes. Usually, there is but one opening—namely, that through which the fœtus has passed, and the presence of a second opening is of considerable importance, particularly if it is not merely a tear in the membranes, but represents a missing portion. Such an opening may be due to the tearing away of a piece of membrane which was more than usually adherent to the uterine wall, or it may be caused by a more important condition, the presence of a second placenta—a *placenta succenturiata*—which has been left behind. If the latter is the true cause, we shall find, on examining the placenta or cord, bloodvessels which have been torn across and which were running to this second placenta. In such cases, or in cases in which a portion of the placenta itself has been left, we must examine the interior of the uterus manually and remove all retained fragments.

As soon as the delivery of the placenta and membranes is complete, the final step consists in washing away all blood-stains from the genitals and thighs, in removing the soiled linen, and in applying the napkin and binder. For washing the patient at this stage a weak solution of lysol is, perhaps, best (half a drachm to the pint). The draw-sheet and small mackintosh are removed, and a dry and warm draw-sheet substituted, as is also done in the case of the patient's night-gown if soiled. The napkin, which had been previously placed in a solution of corrosive sublimate, as has been mentioned, is wrung as dry as possible and applied to the vulva. Unless the patient complains of feeling chilled, the napkin may be applied wrung out of cold solution, as it is usually more soothing when thus used. It should reach upwards under the patient's hips behind and over the abdomen in front. The binder is next applied. It should reach from the level of the ensiform cartilage to the middle of the thighs, and should be fastened with four or five surgical pins. The first of these is placed below the level of the trochanters, the second just above the trochanters, the third at the level of the umbilicus, and the fourth close to the top of the binder. Particular care must be taken to see that the pressure of the binder is so directed that the uterus is pressed downwards into the pelvis and does not rise above the level of the third pin. In the case of a patient with a very flaccid or fat abdomen, it is well to apply a small pad made of one or two towels, folded in half three times, above the fundus and between the third and fourth pin of the binder.

We may now sum up the management of the third stage in a few words. As soon as the infant is born turn the patient on her back and place the hand upon the fundus for the purpose of controlling it. If uterine contractions are infrequent and weak their occurrence can be stimulated by gentle friction of the fundus. So long as no hæmorrhage occurs, we wait until the placenta is detached and expelled from the uterus, and we then express it from the vagina by the Dublin method. If it should not be expelled from the uterus within an hour of the birth of the fœtus, we first attempt to express it, and, if this fails, we remove it manually. The patient is then washed and the napkin and binder applied.

The patient is now comfortably settled, and labour may be considered to be over. The obstetrician should not, however, as a rule, leave the house for a full hour after the birth of the placenta.

ANÆSTHESIA DURING LABOUR.

The beneficial effect of the use of anæsthetics during labour has come to be so well recognised that it is no longer necessary to discuss whether their use is justifiable or not. In obstetrical practice, ether is for many reasons but little used, its place being entirely taken by chloroform, save in the rare instances in which the condition of the patient's heart forbids the use of the latter drug. Ether is more difficult to administer, as it requires a more cumbersome apparatus, the inflammable nature of its vapour renders its use dangerous in the neighbourhood of an artificial light, and its after-effects upon the patient are more unpleasant.

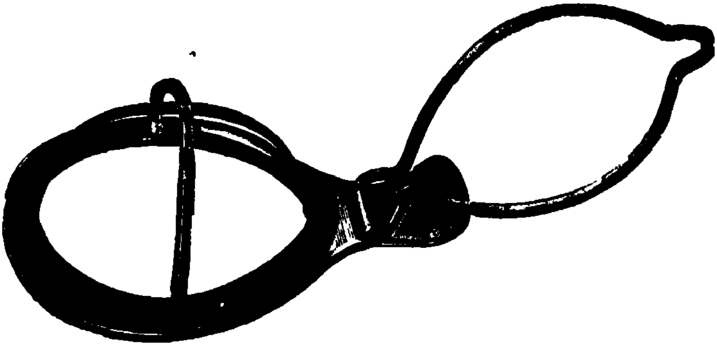

FIG. 200 —SCHIMMELBUSCH'S CHLOROFORM MASK.

Chloroform, however, also must never be administered in the immediate neighbourhood of a candle or lamp, as such a light decomposes it into chlorine gas and hydrochloric acid, inhalation of which may set up a serious form of pneumonia.

Two forms of anæsthesia are used in obstetrical practice—surgical anæsthesia and obstetrical anæsthesia.

Surgical Anæsthesia.—In surgical anæsthesia, the anæsthetic is administered to a sufficient extent to produce complete unconsciousness and abolition of reflexes. This degree of anæsthesia is required in the performance of various obstetrical operations. The mode of administration does not differ in any particular from the mode used in surgery, and the chloroform is best administered upon Skinner's or Schimmelbusch's mask (*v.* Fig. 200), or if necessary on a pocket-handkerchief.

Obstetrical Anæsthesia.—In obstetrical anæsthesia, the anæsthetic is only administered in sufficient quantity to produce a blunting of sensation without complete loss of consciousness. This degree is of use in ordinary cases of labour, when the patient's sufferings are considerable, as it will give immediate relief, and at the same time will not interfere with the course of labour if used at the proper time. To obtain obstetrical anæsthesia, chloroform may be dropped on a Skinner's mask in the ordinary manner, commencing as soon as there is any sign of the onset of a contraction, and ceasing as soon as the patient is obviously not suffering. The patient recovers more or less complete consciousness between the contractions, and on the onset of the next contraction the chloroform is again administered as before. A more simple means of obtaining the same end is by the use of Murphy's* inhaler. This inhaler (*v.* Fig. 201) consists of a metal chamber and a face-piece. The chamber contains a small piece of sponge, on which a drachm of chloroform is poured. The entrance and exit of air are regulated by two rubber valves, so arranged that only inspirations pass through the chloroform chamber. In the original pattern, the face-piece was made to cover the mouth only, as Murphy considered that it was advisable to allow the patient to breath pure air through the nose, as well as chloroform-ladened air through the mouth. This precaution, however, is unnecessary, and in practice it is found very difficult to get a patient at the height of a pain to breathe sufficiently through the mouth to inhale the required amount of vapour. Consequently, a face-piece which covers both mouth and nose is more suitable. The working of the inhaler is very simple. A drachm of chloroform is poured upon the sponge, the inhaler is then given to the patient to hold, and she is told to place it over her mouth and breathe through it every time she feels a pain commencing. As soon as she has inhaled sufficient to cause partial loss of consciousness she drops the inhaler, and the effect of the chloroform inhaled will last as long as the pain of the contraction. Chloroform can be administered in this manner for a considerable time without interfering in any way with the course of labour. Indeed, the dread of increasing the pain some-

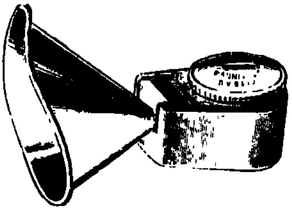

FIG. 201.—MURPHY'S CHLOROFORM INHALER.

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* 'Principles and Practice of Midwifery,' second edition, p. 576.

times prevents a patient from bearing down, and, consequently, the induction of obstetrical anæsthesia tends to increase rather than to lessen the expelling forces. Obstetrical anæsthesia may be induced in any case in which there is no contra-indication to the use of chloroform, and in which the sufferings of the patient are considerable. It should not, however, save under the most exceptional circumstances, be commenced until the patient has passed into the second stage and is actively bearing down, as, if it is commenced at an earlier period, it may have to be continued longer than is advisable.

As is mentioned elsewhere, there is no reason to apprehend any toxic effect on the fœtus from the administration of either chloroform or ether, unless the maternal anæsthesia is very deep and long continued (Ballantyne).[*] According to Duhrssen,[†] a limit of four hours should never be exceeded, but even this period seems to be too long.

THE USE OF ERGOT.

It may not, perhaps, be out of place to devote a few lines to the discussion of the use of ergot of rye during labour. The physiological effect of ergot as far as the uterus is concerned appears to be a lessening of venous tension and an increased venous dilatation, which produce an arterial anæmia of the uterus and its nerve centres, a condition which in turn increases the duration and intensity of the uterine contractions (Wernich). If a sufficient dose is given, the interval between the contractions disappears, and a condition of tonic contraction occurs. Furthermore, it is stated by Lombe Atthill,[‡] and is constantly proved in practice, that ergot will not cause uterine action unless such action has already commenced; that, in other words, it will increase the force and frequency of existing contractions, but that it will not cause their onset. The principal effect of ergot on the uterine contractions of labour is to increase their force, and to tend to make them tonic instead of intermittent. The former of these properties may in many cases be of great value, but the second can only be made use of under certain well-specified conditions. As we know, the intermittent nature of the uterine contractions is of paramount importance in labour. If there was no interval between the contractions, the fœtus would not receive its proper supply of oxygen owing to the obstruction offered to the placental circulation, the patient would rapidly become worn out and unable to bear down, and uterine retraction would occur with such rapidity that, before the necessary dilatation of the orifice and the soft parts had occurred, the lower uterine segment might become overdistended and rupture. Consequently, so long as intermittent contractions of the uterus are necessary to the normal continuance of labour, we cannot administer ergot to the patient. When, however, labour has so far advanced that the occurrence of tonic contractions is advisable, ergot may be administered in fairly large doses. This period is reached when the uterus is empty. In the first stage of labour, ergot may not, perhaps, increase the pressure upon the fœtus and placenta to a dangerous extent, inasmuch as the liquor amnii is still present, but it will delay the dilatation of the uterine orifice. In the second stage, it will materially effect the fœtal circulation by causing continuous pressure upon the placenta and cord, and may cause the rupture of the uterus if there is any obstacle to the speedy expulsion of the fœtus. In the first part of the third stage, it will tend to cause irregular contractions of the uterus and the incarceration of the placenta, but, during and after the second part of this stage, when the uterus is empty, its action will be wholly beneficial. From that time on, the occurrence of tonic contraction is most desirable, as it prevents post-partum hæmorrhage and the accumulation of clots in the uterine cavity, and furthers the process of involution.

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[*] *Op. cit.*

[†] 'A Manual of Obstetric Practice,' English edition, p. 237.

[‡] 'Observations on the Anticipation of Post-partum Hæmorrhage,' etc. (*Trans Royal Acad Med. Ireland*, 1897, p 338)

Many obstetricians recommend the routine administration of ergot at this period of labour, and there is no objection that we can see to such a custom; it may not be always necessary, but it can do no harm. If the obstetrician lives at some distance, he will have his mind at greater ease when leaving his patient if he knows that firm contractions have occurred and will continue. Whatever may be said as to its routine use, ergot is of value in cases of insufficient contraction of the uterus after the third stage owing to muscular weakness, and possibly in cases of subinvolution of the uterus.

Ergot may be administered by the mouth or hypodermically. Ergot administered by the mouth takes from ten to twenty minutes to produce its effect, while given hypodermically it acts in five minutes or less. By the mouth it may be given in the form of the liquid extract in doses of from one to two drachms. Hypodermically, it may be given as citrate of ergotinine or as the liquid extract, in doses of up to $\frac{1}{25}$ grain of the former, and up to a drachm of the latter. If administered in this manner, it must be injected deeply into a muscle and not subcutaneously.[1]

CHAPTER V

CEPHALIC PRESENTATIONS (*continued*)—FACE PRESENTATION, BROW PRESENTATION, FONTANELLE PRESENTATION

Face Presentation—Frequency—Ætiology—Positions—Diagnosis—Mechanism—Abnormal Mechanism, Reversed Rotation of Head—Moulding—Management, Flexion by External Manipulations, by Combined External and Internal Manipulations—Prognosis. Brow Presentation—Frequency—Ætiology—Positions—Diagnosis—Mechanism—Moulding—Management—Prognosis. Anterior Fontanelle Presentation—Ætiology—Positions—Diagnosis—Mechanism—Treatment—Prognosis. Posterior Fontanelle Presentation—Ætiology—Positions—Diagnosis—Mechanism—Moulding—Treatment—Prognosis

FACE PRESENTATION

A FACE presentation is the term applied to the presentation after full extension of the head, as a result of which the face lies lowest.

Frequency.—The frequency of face presentations appears to vary considerably in the practice of different obstetricians. Pinard and Lepage, at the Clinique Baudelocque, met with 26 cases amongst 10,398 labours, or a proportion of 1 in 399. At the Rotunda Hospital, 53 cases occurred amongst 19,293 patients, or a proportion of 1 in 364·01. Spiegelberg, from German statistics, estimates the proportion at 1 in 324. Pinard, at the Maternité and Lariboisière Hospitals, met with 374 cases amongst 92,026 labours, or a proportion of 1 in 247. Churchill, out of nearly 250,000 cases, estimates the proportion at 1 in 231. The statistics of Guy's Hospital show a proportion of 1 in 303 amongst 49,145 cases. Usually, the average proportion is given as 1 in 250.

Ætiology.—A face presentation is almost invariably a secondary or resultant presentation, the result of some interference with the mechanism of a vertex presentation. In exceptional cases, the alteration in the attitude of the fœtus may be primary—that is to say, may be present before labour commences, owing to some deformity which is present either in the fœtus or in the uterus, and which prevents the former from assuming its normal attitude. We must, therefore, classify the causes of face presentation according as they produce that presentation primarily

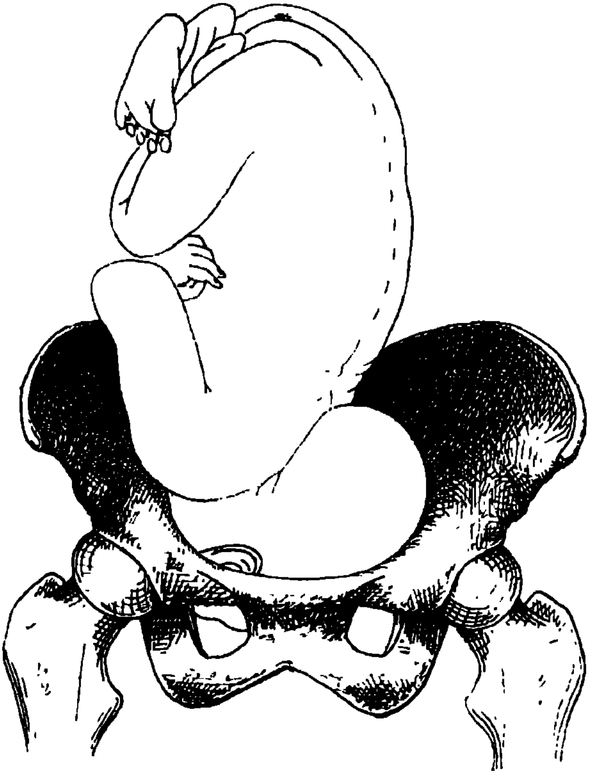

FIG. 202.—FIRST FACE PRESENTATION, THE BACK IN FRONT (Farabœuf.)

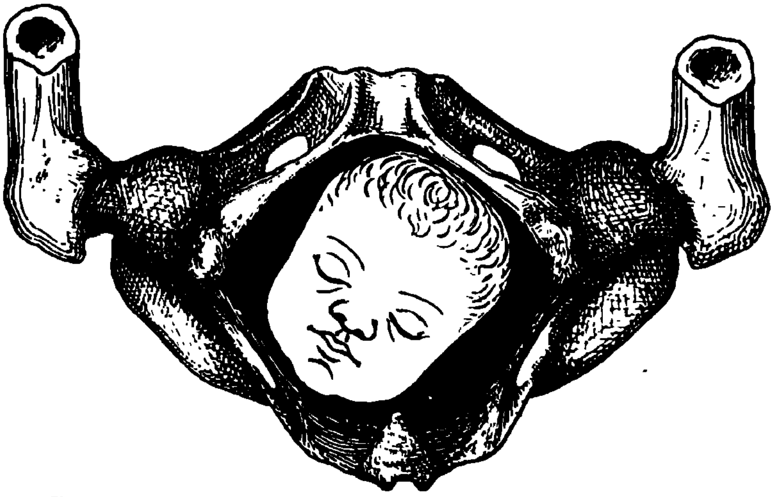

FIG. 203.—FIRST FACE PRESENTATION, WITH THE BACK IN FRONT. The face presenting at the brim, as felt by vaginal examination.

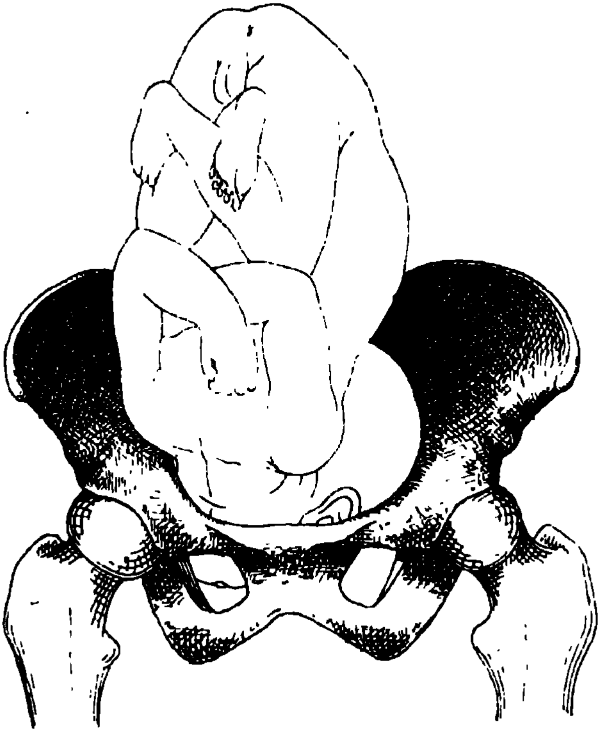

FIG 204 —FIRST FACE PRESENTATION, THE BACK BEHIND (Farabœuf.)

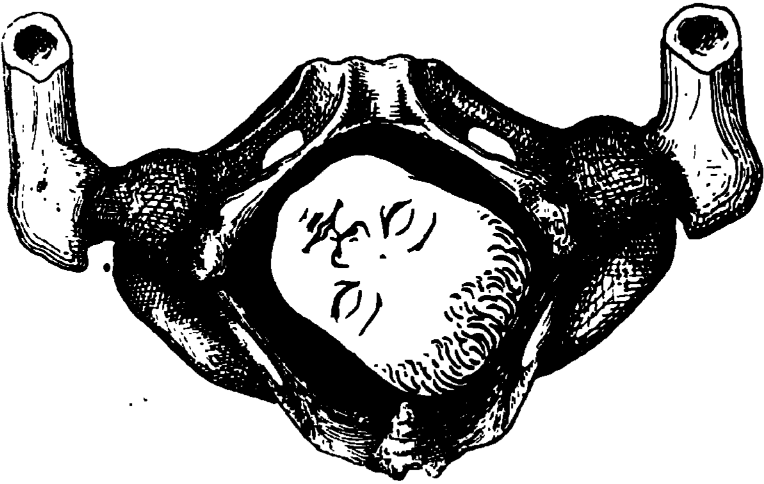

FIG 205. -FIRST FACE PRESENTATION, WITH THE BACK BEHIND. The face presenting at the brim, as felt by vaginal examination.

or secondarily. The causes which produce primary presentation of the face are few in number. Tumours about the neck of the fœtus, such as a greatly enlarged thyroid, may force the head into a position of extension. Hydrothorax may have the same effect. An anencephalous fœtus—*i.e.*, a fœtus in which the cranial bones are defective—may present by the face owing to shortness or comparative absence of neck. Tumours, situated so low in the uterus as to interfere with the normal accommodation between the head and the lower uterine segment, may also cause extension.

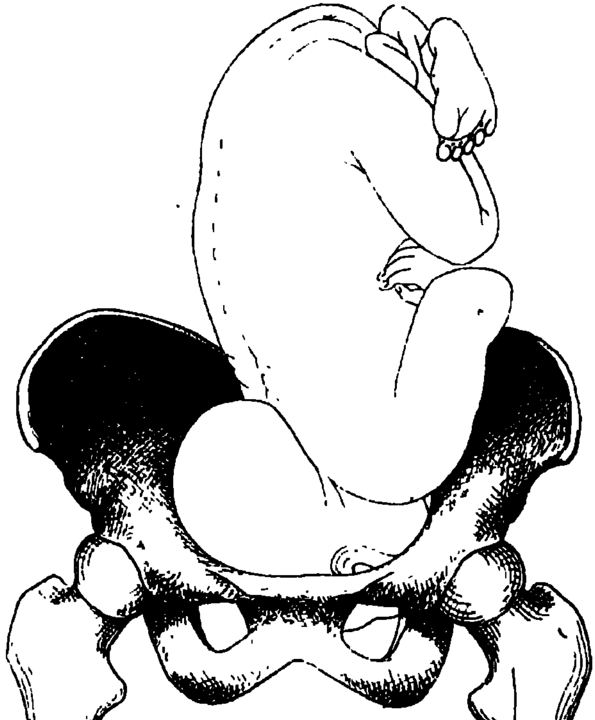

FIG. 206.—SECOND FACE PRESENTATION, THE BACK IN FRONT. (Farabœuf.)

The causes which produce a secondary face presentation are more numerous. If we recall the ~~factors which bring about in~~creased flexion in a vertex presentation, we shall more readily understand the factors which bring about the opposite condition. The first factor in the production of flexion is the relation between the shape of the head and the shape of the pelvis. The occiput is sheer in outline and tends to slip readily past the pelvic brim, while the sinciput, on the other hand, is more prominent and consequently meets with greater resistance from the pelvic brim. As a result, the occiput descends more rapidly than the sinciput. The second factor is to be found in the fact that the fœtal-axis pressure acts upon the base of the skull at a point nearer to the occiput than the sinciput and, consequently, exerts more force upon the former and drives it downwards more rapidly. We can thus readily understand that anything that increases the resistance to the descent of the occiput, or that makes the fœtal-axis pressure act with greater force upon the sinciput than upon the occiput, will tend to cause a more rapid descent of the sinciput than of the occiput, and this descent will, in the majority of cases, continue until the head has

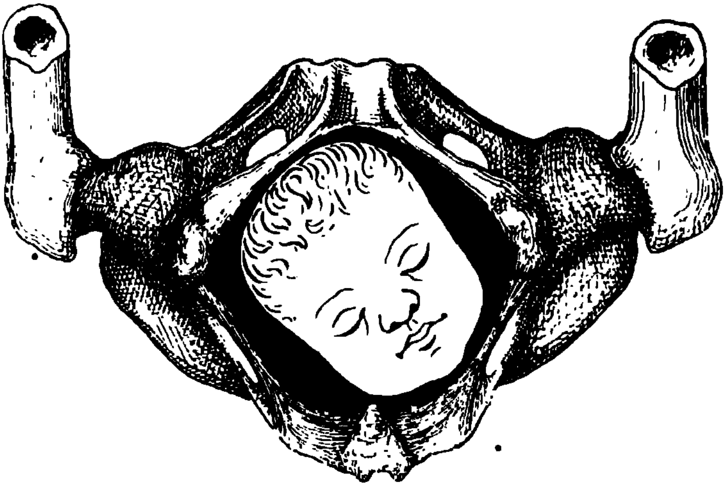

FIG. 207.—SECOND FACE PRESENTATION, WITH THE BACK IN FRONT

The head presenting at the brim, as felt by vaginal examination.

come into a position of stable equilibrium—that is to say, until the occiput is in contact with the back of the fœtus and the face presents. The usual causes of increased resistance to the descent of the occiput are contraction of the pelvis and obliquity of the uterus, and these causes are rendered more effective by association with a large fœtus. In a pelvis which is contracted in its antero-posterior diameter, the head tends to move towards the side at which the occiput lies as soon as uterine contractions commence, and the result of this may be that the occiput projects slightly beyond the brim, and that, consequently, its descent is retarded. Similarly, if the uterine axis is deflected away from the side at which the occiput lies, the contractions, instead of driving the fœtus into the pelvic cavity, tend to drive the occiput against the brim and so to retard its descent (Matthews Duncan). A rarer cause of face presentation will be found in a dolicho-cephalic head—that is, a head in which the occiput is unduly prominent. Such a condition will not only cause increased obstruction to the descent of the occiput, but will also alter the effect of the fœtal-axis pressure upon the position of the head, inasmuch as now, owing to the increased length of the occiput, this pressure may act upon a point of the head which is nearer to the sinciput than to the occiput. The question of the relation of a dolicho-cephalic head to face presentations cannot be regarded as quite settled. There is no doubt that if there is such a thing as a dolicho-cephalic head in a fœtus *in utero* it will tend to cause a face presentation (Hecker*); but, on the other hand, the dolicho-cephalic head, which an infant born as a face presentation usually possesses, is, in all probability, most frequently the result of moulding. There is very little proof that a true or primary

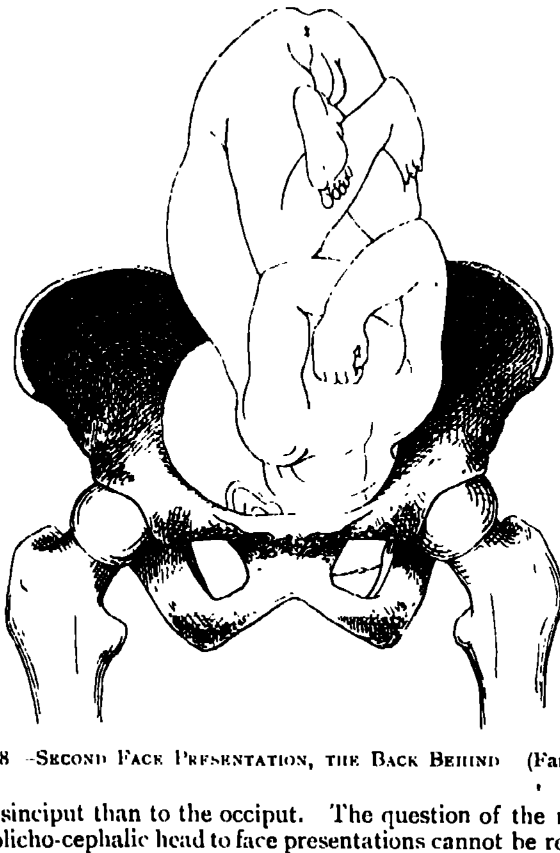

FIG. 208 —SECOND FACE PRESENTATION, THE BACK BEHIND (Farabœuf.)

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* *Schädelform bei Gesichtslagen*, 1869, and *Archiv f. Gynak.*, II, 429.

dolicho-cephalus exists, and, consequently, too much stress need not be laid upon it as a cause of face presentation.

In addition to the foregoing causes of face presentation, there are others whose mode of action it is difficult to explain. Strictly speaking, the causes to which we refer are causes, not of face presentation in particular, but of any abnormal presentation, and produce their effect by altering the normal adaptation which exists between the fœtus, as a whole, and the uterine cavity, or between the fœtal head and the lower uterine segment. They are as follows:—Hydramnios, twins, macerated fœtus, pluriparity, and a large fœtus.

Positions.—In face presentation, as in vertex presentation, the fœtus can lie in one of two positions according as the back is directed to the left or to the right. Each of these positions can again be divided into two more, according as the back is directed anteriorly or posteriorly. Accordingly, the different positions can be tabulated as follows:—

First position, back to the left.	In front, first position of Naegele, sometimes termed right mento-posterior, or shortly, R.M.P.
	Behind, fourth position of Naegele, right mento-anterior, or R.M.A.
Second position, back to the right.	In front, second position of Naegele, left mento-posterior, or L.M.P.
	Behind, third position of Naegele, left mento anterior, or L.M.A.

It will be noticed that each of these positions corresponds with the position of the vertex of the same number. For instance, a first vertex presentation with the back in front—*i.e.*, a left occipito-anterior position—becomes, if extension of the head occurs, a first position of the face with the back in front or a right mento-posterior position, and similarly with the other positions. The indicator, or *point de repère*, which is used in Naegele's classification, is in vertex presentation the occiput, in face presentation the chin.

As a face presentation is, in the great majority of cases, secondary to a vertex presentation, the order of frequency of the different positions is very much the same. The first position with the back in front—first position of Naegele—is the most common; the second position with the back behind—third position of Naegele—the next most common; while the other positions are rare. Considerable differences of opinion, however, exist in the minds of different authorities as to the relative frequency of the various positions.

Diagnosis.—The diagnosis of face presentation can be made by abdominal palpation, vaginal examination, and auscultation.

Abdominal Palpation.—The pelvic pole of the fœtus is found at the fundus of the uterus, and is recognised by the characteristics which have already been mentioned. The lie of the fœtus is found to be longitudinal, with the back towards one or other side, according to the position. If the back is posterior, the limbs are felt with greater distinctness than in the case of a vertex presentation, owing to the extension of the head, which forces the abdominal wall and limbs of the fœtus into close contact with the anterior uterine wall. For a similar reason, if the back is anterior it lies at a deeper level in the uterus, and the limbs are felt with greater difficulty than in a vertex. The head is found in the lower pole of the uterus, if it has not passed below the brim. The occiput forms a rounded and prominent tumour, which completely fills the pelvic brim on the side corresponding to the back of the fœtus. The chin is felt as a small tumour 'like an animal's hoof' (Budin), resting on the brim on the same side as the limbs. The occiput lies at a higher level than the chin, and the groove of the neck runs obliquely in a corresponding direction. If the head has passed below the brim, the fingers can be sunk deeply into the pelvis on the side of the limbs, while on the side of the back they are stopped by the prominence formed by the occiput. Accordingly, if we contrast the results of abdominal palpation in a vertex presentation and in a face presentation, we find that, whereas in a vertex the posterior aspect of the body and the anterior aspect of the head are more readily palpated, in a face presentation the anterior aspect of the body and the posterior aspect of the head are more readily palpated, a difference which is, of course, due to the altered attitude of the fœtus. A striking

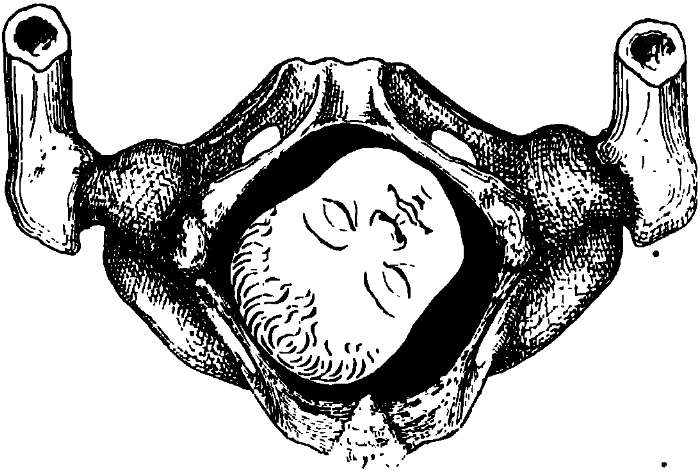

FIG. 209.- SECOND FACE PRESENTATION, WITH THE BACK BEHIND.
The face presenting at the brim, as felt by vaginal examination

proof of the close apposition of the anterior surface of the fœtus to the uterine wall is furnished by the fact that in face presentation it has been found possible to feel the pulsations of the fœtal heart through the abdominal wall in a thin subject (Lefour, Fischer). The position of the fœtus is determined by noting the side at which the limbs are situated.

Vaginal Examination.—At the commencement of labour it is difficult to reach the presenting part owing to its high situation; but as the head descends the face is felt, and can be readily

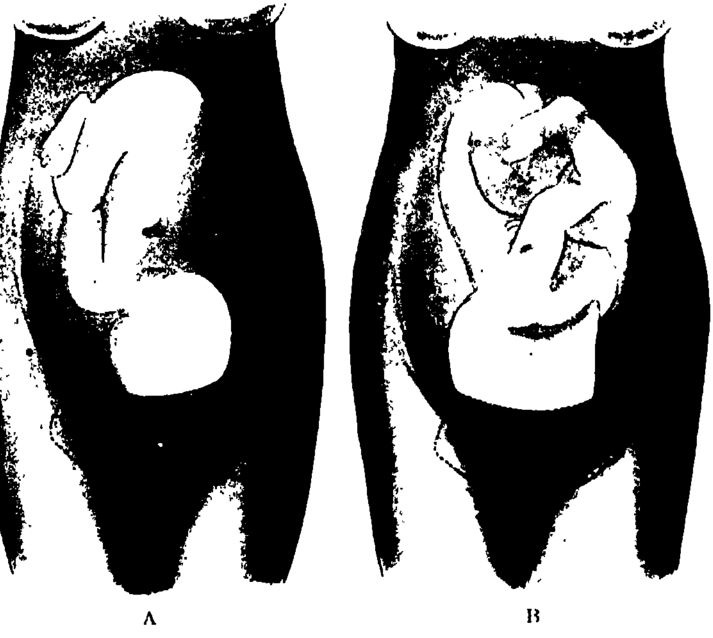

FIG. 210.—DIAGRAM REPRESENTING THE FŒTUS AS FELT BY ABDOMINAL PALPATION IN FACE PRESENTATION.

A, First position of face, back in front; B, second position of face, back behind. The unshaded portions of the fœtus are those that are felt most distinctly

recognised by its characteristic outlines. The diagnostic points are the supra-orbital ridges, the malar bones, and the mouth. The latter may be mistaken for the anus, but if its relation with the other landmarks is taken into consideration a mistake will not be made. It has been recommended to pass the finger into the aperture which is felt in order to make a diagnosis. In the case of the mouth, the alveolar ridges and the tongue are felt, the lips do not grasp the fingers, and the fœtus may make slight sucking efforts. In the case of the anus, the absence of alveolar ridges and tongue is noticed, and the sphincter ani grasps the finger, which on being withdrawn may be covered by meconium. Although we have given this method of making a diagnosis, we altogether condemn such a practice, as the efforts at sucking which the introduction of the finger into the mouth may cause will very probably lead to the inspiration of mucus by the fœtus, and so to subsequent asphyxia.

Later in labour, when a large caput succedaneum has formed, the difficulty of diagnosis is increased, owing to the obscuring of the outlines of the presenting part. In such cases, a hurried examination will frequently cause a face to be taken for a breech, or *vice versa*. A little care will, however, always enable us to avoid such a mistake, as by passing a finger upwards to one or other side of the presenting part, in the case of a face presentation we shall reach the ear, and in the case of a breech presentation we shall reach a groove between a thigh and the body, or the groove between the thighs themselves.

The position of the fœtus can be determined by noting the relation of the supra-orbital ridges and the mouth to the pelvis. In the first position, the supra-orbital ridges are found in the left half of the pelvis, the mouth in the right half, while their relation to the median coronal plane of the pelvis will show whether the back is in front or behind. Similarly, in the second position the supra-orbital ridges will be found in the right half of the pelvis and the mouth in the left half.

Auscultation. From what has been already said of the attitude of the fœtus, it will be seen that whereas in a vertex presentation the fœtal heart is most easily heard over the back of the fœtus, in a face presentation it is most easily heard over the chest (*v.* Fig. 211). Further, in cases in which the back of the fœtus is directed anteriorly, there will be some difficulty in hearing the heart; while when the limbs are anterior, it will be heard with unusual distinctness. The heart-sounds will be heard best at the commencement of labour about the level of the umbilicus and to the right or the left of the middle line, according as the fœtus lies in a first or a second position.

Mechanism.—If the general principles, which govern the mechanism of a vertex presentation, have been mastered, there will be no difficulty in following and remembering the mechanism of a face presentation. As soon as the expulsion of the fœtus commences, the head must first be brought into a position of stable equilibrium, and at the same time its smallest available diameters must be brought into correspondence with the diameters of the pelvic brim. This proceeding, which in the case of a vertex presentation is brought about by flexion, in the case of a face is brought about by extension. Then, as the head descends, it must rotate in order to keep its diameters in correspondence with the most suitable diameters of the pelvic cavity and outlet;

and, accordingly, internal rotation takes place as in a vertex presentation, save that in the latter the occiput under normal circumstances rotates in front, in a face presentation the chin rotates in front. Next, in order that the head may follow the pelvic curve and emerge through the vulva, it must move forwards under the symphysis. This movement, which in the

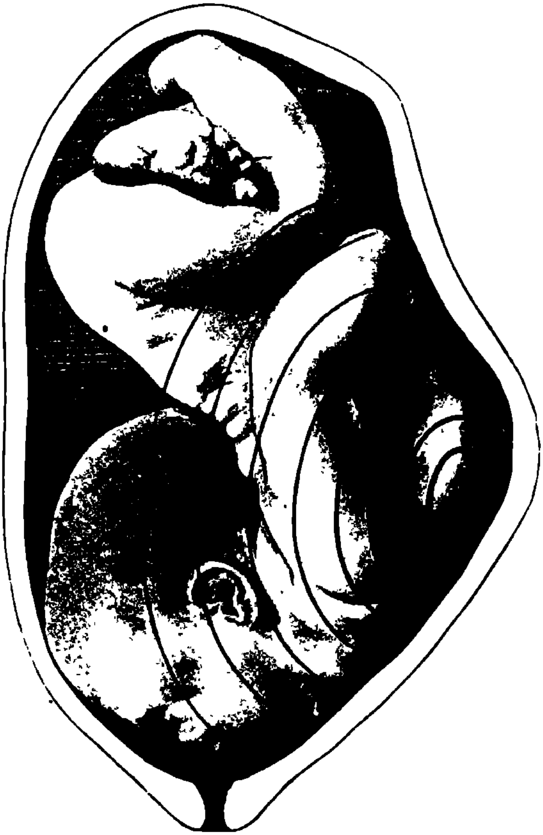

FIG. 211.—SITE OF MAXIMUM INTENSITY OF HEART-SOUNDS WHEN THE HEAD IS EXTENDED (Bumm.)

case of a vertex presentation is obtained by extension, in the case of a face presentation is obtained by flexion. Finally, after the birth of the head, restitution must take place, in order to bring back the head to its normal relation to the shoulders, and external rotation proper must occur in consequence of the internal rotation of the shoulders from one or other oblique diameter into the antero-posterior diameter of the outlet. We thus see that if, in the mechanism of a vertex presentation, we substitute extension for flexion, flexion for extension, and the chin for the occiput, we get the mechanism of a face presentation, and this we shall now describe in greater detail.

Descent.—Under the influence of the uterine contractions the head descends into the pelvic brim, with its antero-posterior diameters corresponding to the oblique diameter, or, according to

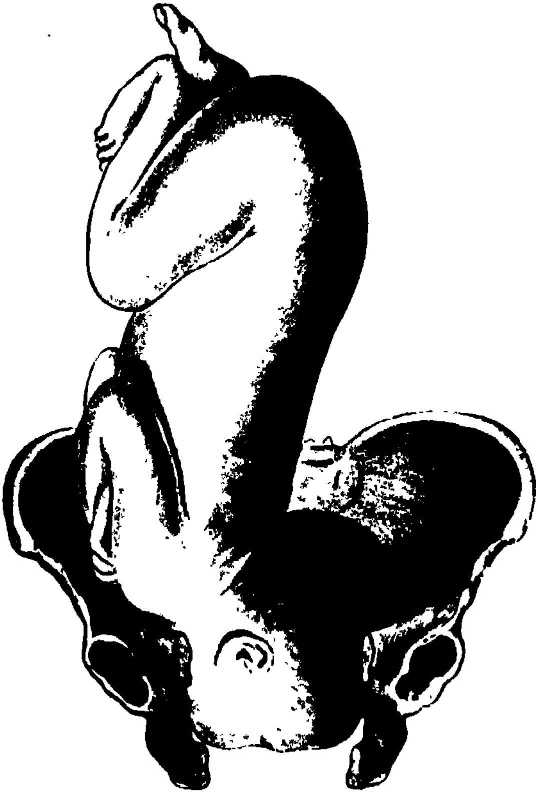

FIG. 212.—THE MECHANISM OF FIRST FACE PRESENTATION.

The head has passed the brim and extension is complete.

some authorities, to the transverse diameter of the brim. As the head descends extension occurs.

Extension.—The second act in the mechanism of a face presentation is the completion of extension, the result of which is to bring the occiput into contact with the back of the fœtus, and to make the cervico-bregmatic diameter—or, according to some, the cervico-frontal diameter — the greatest engaging diameter (c Fig. 212). The cause of the completion of extension is very obvious. Once the head has reached such an attitude that its posterior projection is greater than its anterior projection, the fœtal-axis pressure, acting through the condyles, tends to increase the extension present. Further, owing to the shape of the head when in a position of partial extension, the resistance offered by the sides of the pelvis to the descent of the vertex and occiput is greater than that offered to the descent of the chin, and, consequently, the latter descends more rapidly.

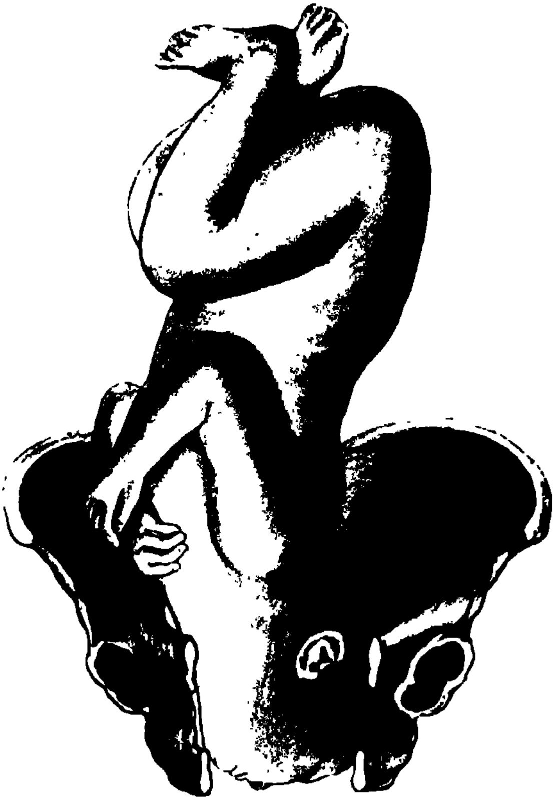

FIG. 213.—THE MECHANISM OF FIRST FACE PRESENTATION.
The head has reached the pelvic floor and internal rotation has commenced

Internal Rotation.—The third act consists in the anterior rotation of the chin. At the completion of extension, the head was advancing with the cervico-bregmatic diameter corresponding to one of the oblique diameters and with the chin lowest, and now, in consequence of internal rotation, the cervico-bregmatic diameter corresponds with the antero-posterior diameter of the pelvic outlet, and the chin comes to lie beneath the symphysis (*v.* Fig. 214). If the chin originally lay at the posterior end of either oblique diameter - *i.e.*, in either the first or second position of Naegele—the head rotates through three-eighths of a circle; if it originally lay at the anterior end—*i.e.*, in either the third or fourth position of Naegele—the head rotates through one-eighth of a circle. The anterior rotation of the chin is in obedience to the general law which governs internal rotation, that whatever portion of the presenting part lies lowest rotates in front under the influence of the pelvic floor. If the forehead lies lowest, then it will rotate in front, and one of the most serious complications of labour results. Internal rotation occurs later in face presentations than in a vertex presentation, as, on account of their length, the posterior vertical diameters of the head must have passed the brim before it can occur.

Flexion.—The fourth act consists in the occurrence of flexion by means of which the head, pivoting round the lower margin of the symphysis, is born. The face proper appears first, then the forehead, the bregma, the vertex, and lastly the occiput. The cause of flexion is to be found in the fact that as soon as the chin comes to lie beneath the pubic arch it is practically free from all pressure from above, while the weight of the uterine contractions is transmitted to the occiput, thus driving it downwards and forwards over the pelvic floor.

External Rotation.—The fifth act is made up of restitution and external rotation proper, and there is in it no difference of importance between the mechanism of a face presentation and that of a vertex. Restitution carries the chin back to the side at which it originally lay, and external rotation proper, the result of internal rotation of the shoulders, carries it on in the same direction.

The foregoing description is a general one, and applies to the different positions of the fœtus. It may now be well to describe the mechanism of each position in a few words.

First Position, Back to the Left.—In the first position, with the back in front, first position of Naegele, right mento-posterior, the fœtal head enters the pelvis with a diameter between the mento-occipital and the cervico-bregmatic diameters corresponding to the right oblique diameter of the pelvis. Descent and extension then occur, and the cervico-bregmatic diameter becomes the engaging diameter. The head continues to descend with the chin lying lowest, and as soon as the pelvic floor is reached internal rotation occurs, and the chin, which up to this lay at the posterior end of the right oblique diameter, rotates through three-eighths of a circle, and comes to lie under the pubic arch. The shoulders, which first lay in the left oblique diameter of the pelvis, follow part of this movement and rotate into the right oblique. Flexion next occurs, and the face, vertex, and occiput in turn appear from above the perinæum. As soon as the head is free restitution takes place, and the chin rotates to the right through one-eighth of a circle. Finally, as the shoulders descend, their internal rotation takes place, and the anterior shoulder, which orresponded to the anterior end of the right oblique diameter, rotates in front and lies behind the symphysis, causing a corresponding external rotation of the chin to the right through another

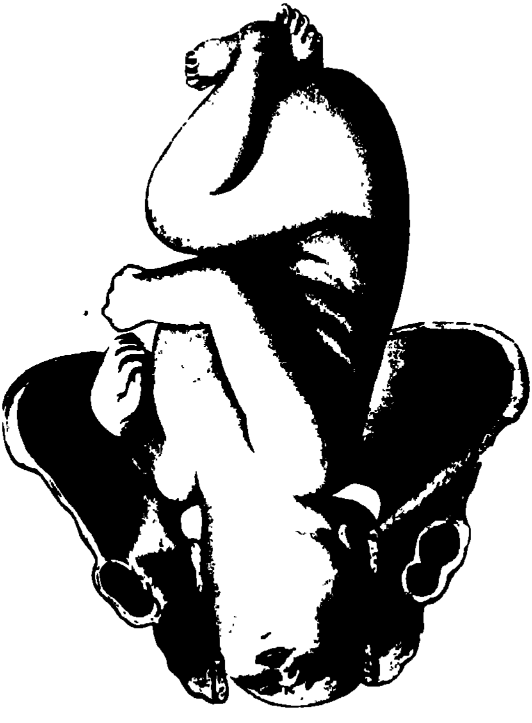

FIG. 214.—THE MECHANISM OF FIRST FACE PRESENTATION.
Internal rotation is complete, and the chin lies below the symphysis.

eighth of a circle, so that it points towards the mother's right thigh. The shoulders and trunk are then born.

In the first position, with the back behind—fourth position of Naegele, right mento anterior—the head enters the brim, with the diameter between the mento-occipital and the cervico-bregmatic diameters, corresponding to the left oblique diameter of the pelvis. Descent and extension occur, and the cervico-bregmatic diameter becomes the engaging diameter. Internal rotation occurs through one-eighth of a circle, and brings the chin from the anterior end of the left oblique diameter to lie under the symphysis. Flexion occurs as before, the head is born, and restitution follows. Finally, the shoulders, which engaged in the right oblique diameter, rotate into the antero-posterior diameter, and at the same time external rotation proper carries the chin back again to point towards the mother's right thigh.

Second Position, Back to the Right.—In the second position, with the back to the front—second position of Naegele, left mento-posterior—the fœtal head enters the pelvis, with a diameter between the mento occipital and the cervico-bregmatic diameters, corresponding to the left oblique diameter of the pelvis. Descent and extension occur, and the cervico-bregmatic diameter becomes the engaging diameter. The head continues to descend with

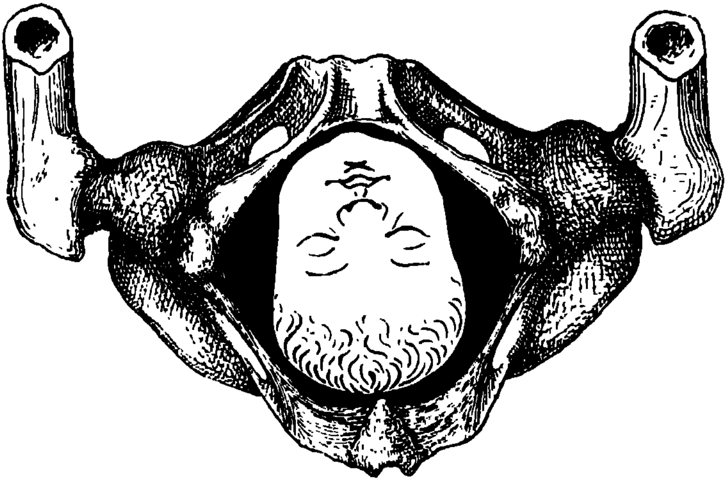

FIG. 215. THE MECHANISM OF FIRST FACE PRESENTATION.
The head after internal rotation has occurred, as felt by vaginal examination.

the chin lying lowest, until the pelvic floor is reached, when internal rotation occurs, and the chin, which up to this lay at the posterior end of the left oblique diameter, rotates through three-eighths of a circle, and comes to lie under the symphysis. The shoulders, which first lay in the right oblique diameter, follow part of this movement, and come to lie in the left oblique diameter. Flexion occurs as before, the head is born, and restitution follows. Finally, the anterior shoulder rotates in front, and the accompanying external rotation proper carries the chin back again to point to the left thigh of the mother.

In the second position, with the back behind—third position of Naegele, left mento-anterior—the head enters the brim with a diameter between the mento-occipital and cervico-bregmatic diameters, corresponding to the right oblique diameter of the pelvis. Descent and extension occur, and the cervico-bregmatic diameter becomes the engaging diameter. Internal rotation occurs through one-eighth of a circle, and brings the chin from the anterior end of the right oblique diameter to lie under the symphysis. Flexion occurs as before, the head is born, and restitution follows. Finally, the anterior shoulder rotates in front, and the accompanying external rotation proper carries the chin back again to point towards the left thigh of the mother.

Abnormalities of Mechanism in Face Presentation.—The only

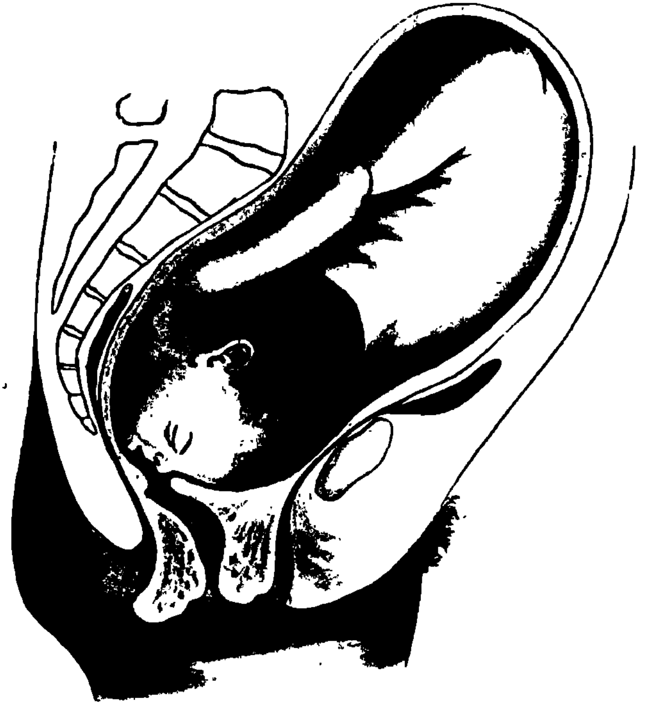

FIG. 216.—REVERSED ROTATION OF THE HEAD

The head after internal rotation has occurred, and the chin rotated into the hollow of the sacrum.

abnormality in the mechanism of a face presentation which is of practical importance is that of reversed rotation of the head, in which the chin rotates into the hollow of the sacrum.

Reversed Rotation of the Head.—Just as in a vertex presentation the occiput may rotate into the hollow of the sacrum instead of rotating anteriorly, so in a face presentation the chin may rotate in the same direction (*v.* Fig. 216). The analogy, however, here stops, for whereas in posterior rotation of the occiput delivery most usually occurs spontaneously, in posterior rotation of the chin delivery by any means short of craniotomy is usually impossible. The reason of this is very clear. As we have already explained when discussing the mechanism of a vertex presentation, the parturient canal is in the form of a curve, with the concavity forwards, and if the fœtus is to traverse this canal, it must be capable of accommodating itself to this curve. In the case of a vertex presentation, this accommodation occurs during the final act of extension of the head, and in the normal mechanism of a face presentation it occurs during flexion. But, in the case of a face presentation with the chin behind, accommodation cannot take place, as, in order that it may do so, the head must extend, and extension has already occurred to the utmost possible degree. Further, the occiput is lodged behind the symphysis in such a manner that, even if the neck permitted of additional extension, the latter could not occur. Another way of explaining the impaction which occurs in these cases is as follows:—The occiput cannot escape from behind the symphysis, consequently, if the head is to be born, the chin must move forward over the perinæum until it clears the latter. The neck is, however, not long enough to allow this to take place unless the fœtal trunk descends further into the pelvis; and this descent is impossible, as there is no room for both the occiput and the chest of the fœtus at the same level in the pelvis (*v.* Fig. 216). Accordingly, if this deviation from the normal mechanism occurs, the further delivery of the fœtus is impossible, save perhaps in the case of a very large pelvis and of a small or macerated fœtal head.

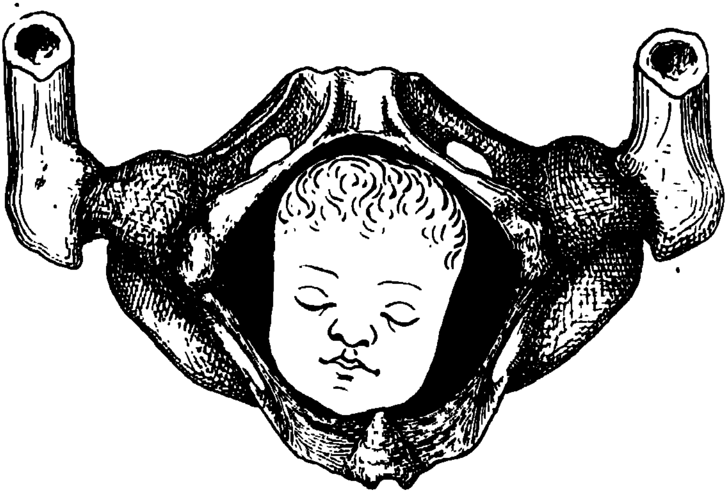

FIG. 217.—REVERSED ROTATION OF THE HEAD.

The face as felt by vaginal examination.

Moulding.—The moulding of the head in face presentation is usually considerable, and is very characteristic. As a result of the pressure of the pelvis, the vault of the head is flattened, while the forehead and the occiput become more prominent. In consequence, there is a diminution in the length of the cervico-bregmatic, cervico-frontal, sub-occipito-bregmatic, supra-occipito-mental, bi-temporal, and bi-parietal diameters, and a compensatory increase in the length of the occipito-frontal and occipito-mental diameters (*v.* Fig. 218). The caput succedaneum is also usually well marked in consequence of the soft and yielding nature of the tissues of the face. It usually forms about the lower portion of the cheek and the angle of the mouth, and on the right or left side, according as the fœtus lay in the first or second position. If the chin rotates posteriorly, the caput forms over the eyes and forehead. In some cases extreme temporary deformity and disfigurement may occur, the eyelids and lips becoming enormously swollen. Sub-conjunctival hæmorrhages are also met with, and ecchymosis of the skin. To such an extent may the latter occur, that the face may be quite black. Mauriceau relates an instance of such a case, in which the mother attributed the appearance of the child to the impression produced by the sight of a negro a short time previous to delivery. Traces of the changes produced by moulding frequently persist during life, but the disfigurement produced by the caput succedaneum passes off in a few days.

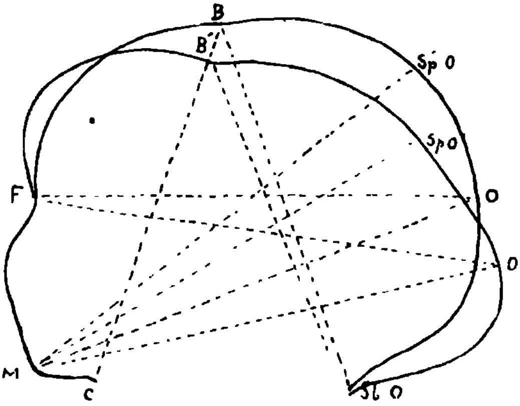

FIG. 218.—THE MOULDING OF THE HEAD IN FACE PRESENTATION.
The black outline shows the unmoulded, the red the moulded head (Budin

Management.—We have seen from the foregoing account of the mechanism of labour that, in the majority of cases, when the normal mechanism occurs, there is nothing to prevent the fœtus from being delivered spontaneously. On the other hand, we have also seen that delivery is slow, and that in rare cases the chin may rotate posteriorly, and the further progress of the case be prevented. Accordingly, the first point in discussing the management of face presentations is to decide the question, Is it

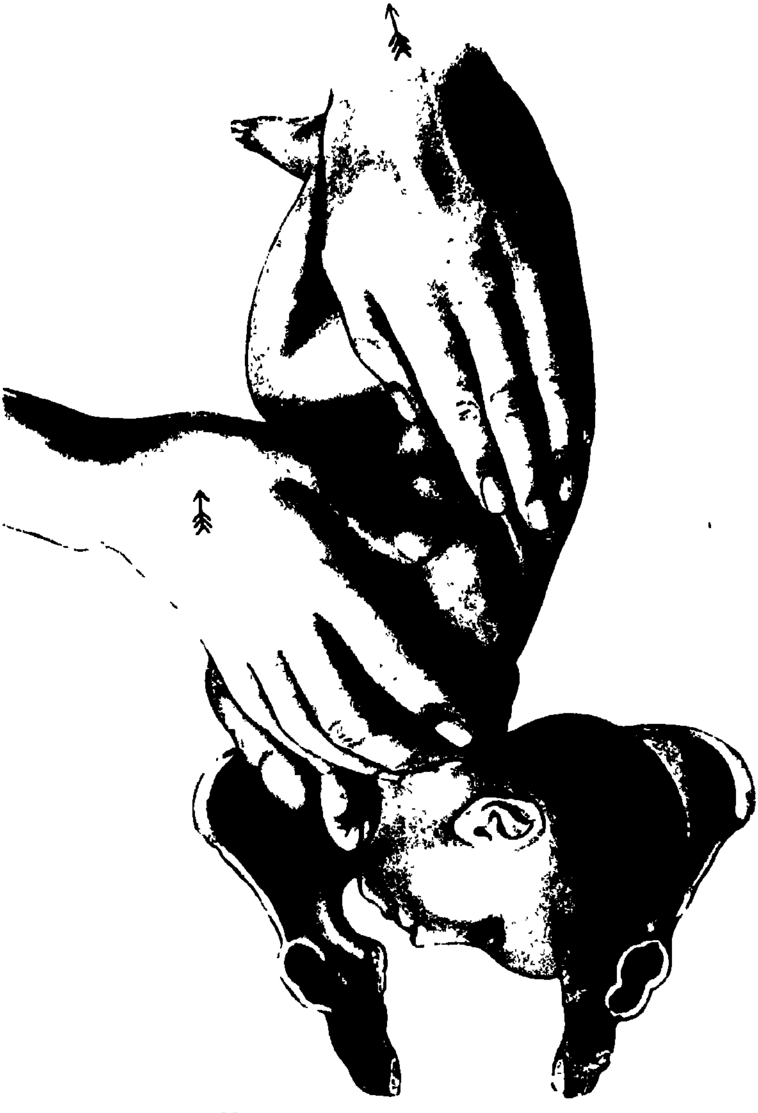

FIG. 219.—SCHATZ' METHOD OF CONVERTING A FACE PRESENTATION INTO A VERTEX: THE FIRST STEP.

The arrows show the direction in which the hands move.

necessary to change every face presentation into a vertex, or may it be allowed to persist? In order to answer this question, we must first ascertain the various methods by which a face can be turned into a vertex, or, in other words, by which full flexion of the head can be obtained.

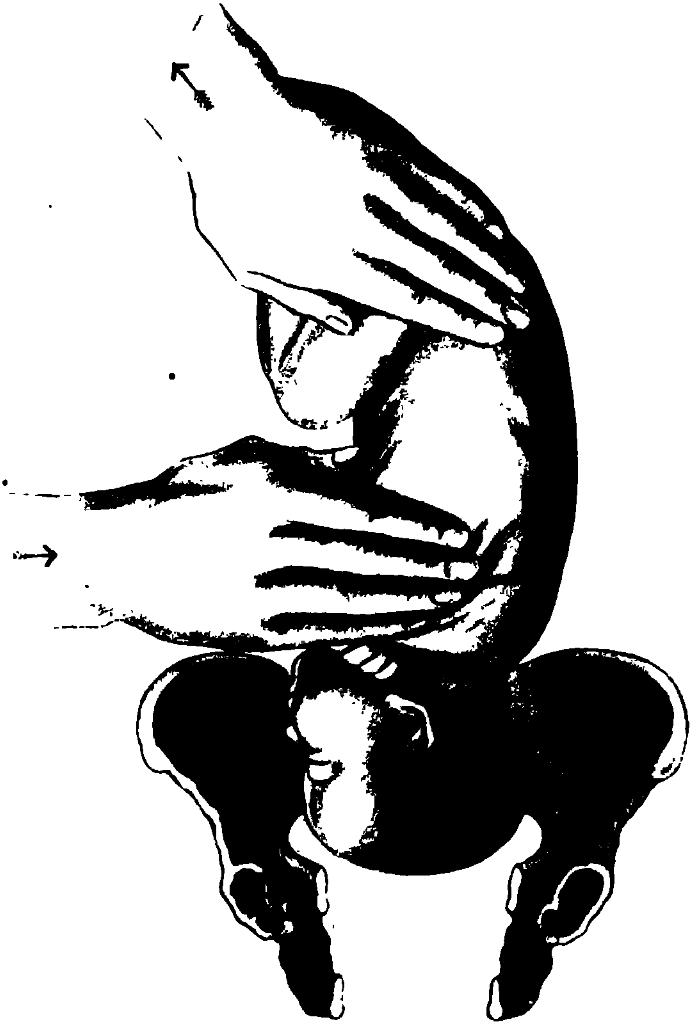

FIG. 220.—SCHATZ' METHOD OF CONVERTING A FACE PRESENTATION INTO A VERTEX: THE SECOND STEP.

• The arrows show the directions in which the shoulders and back are respectively pushed

Flexion by External Manipulations.—The method of converting a face presentation into a vertex by external manipulations alone was introduced by Schatz* in 1873, and has since been known by his name. In order to perform it successfully, ~~the face must~~ be free above the brim, the membranes unruptured, and the abdominal wall lax. Unfortunately, it is usually impossible to obtain the first two of these conditions, as it often happens that the existence of a face presentation is not discovered until the head is fixed, and perhaps the membranes ruptured as well. The necessary laxity of the abdominal wall can always be obtained by the administration of an anæsthetic. The patient lies on the back as if for the performance of abdominal palpation, and the operator ascertains by careful palpation the position of the fœtus. Then, in the interval between two uterine contractions, he grasps the anterior shoulder with one hand and the back just below the

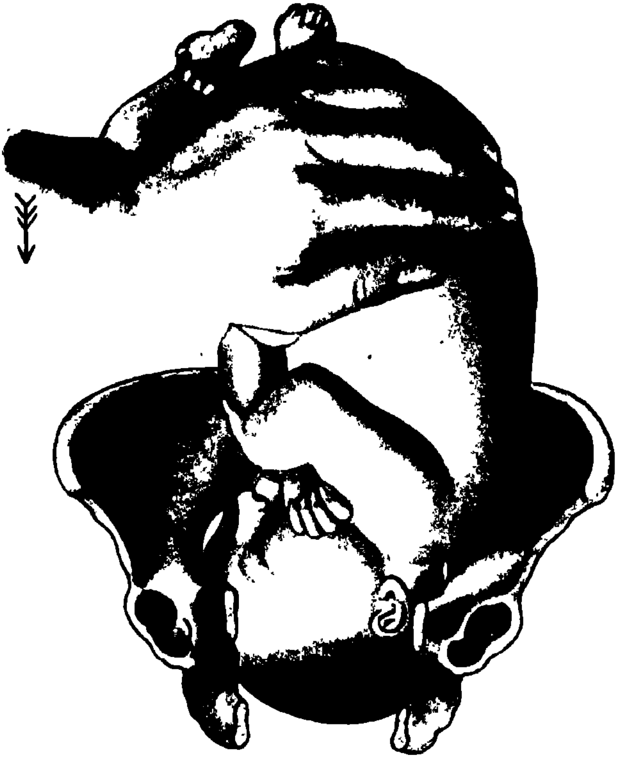

FIG. 221 – SCHATZ' METHOD OF CONVERTING A FACE PRESENTATION INTO A VERTEX: THE FINAL STEP.

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* *Archiv f. Gynak.*, V., 306

breech with the other, and endeavours to draw the fœtus towards the fundus (*v.* Fig. 219). This procedure straightens the fœtus, and brings the head into a position between extension and flexion. The hand on the anterior shoulder then presses the latter in the direction of the back of the fœtus, while the other hand presses the breech in the opposite direction, and so produces a flexed

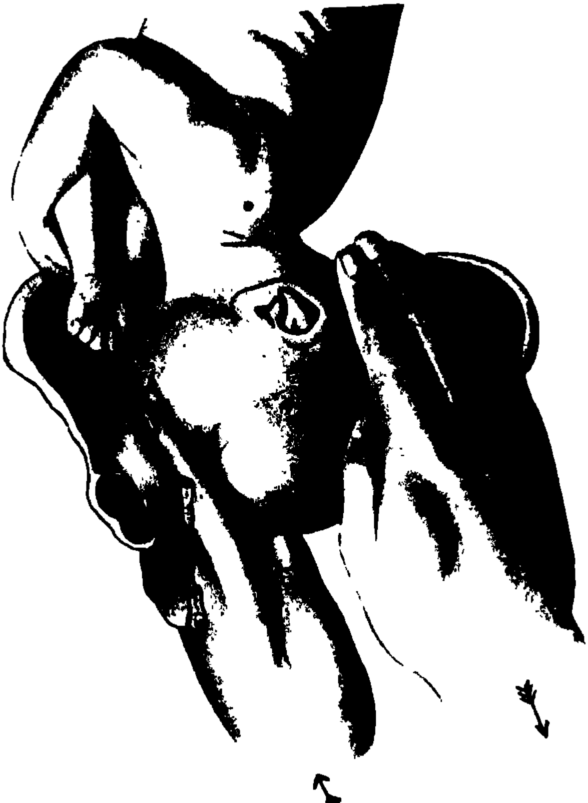

FIG. 222.—BAUDELOCQUE'S METHOD OF CONVERTING A FACE PRESENTATION INTO A VERTEX: THE FIRST STEP.

The fingers of the left hand in the cervix push the lower jaw upwards, while the other hand on the abdominal wall pushes the occiput downwards

position of the head (*v.* Fig. 220). Finally, the hand on the breech presses straight downwards, and so drives the vertex into the brim (*v.* Fig. 221). The head must be kept in this position with the hand, or by the application of a tight binder, until it fixes, or else the face presentation may recur. If the uterine orifice is fairly well dilated, the rupture of the membranes will hasten fixation.

Flexion by Combined External and Internal Manipulations.—There are two methods by which flexion of the head can be obtained by combined manipulations, provided that the head is not too deeply fixed in the pelvis.

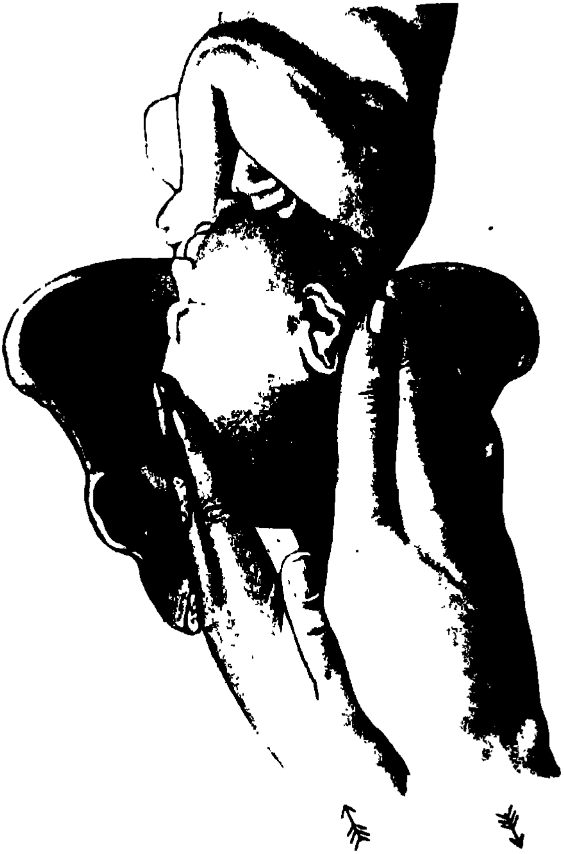

FIG. 223. BAUDELOCQUE'S METHOD OF CONVERTING A FACE PRESENTATION INTO A VERTEX: THE SECOND STEP.

The fingers of the left hand push the forehead upwards, the outer hand continuing to push the occiput downwards.

(1) *Baudelocque's Method.**—For the performance of this method, the uterine orifice must be sufficiently dilated to admit two fingers, and the patient must, if possible, be under an anæsthetic. She is placed in the cross-bed position, and the operator passes

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* 'L'Art des Accouchements,' 1789, vol ii, pp 36-40.

into the vagina the hand corresponding to the side at which the chin lies. Then, passing two fingers into the uterus, he applies upward pressure first upon the lower jaw (*v.* Fig. 222), then upon the upper jaw, and lastly on the forehead, while at the same time he presses down the occiput from without with the other hand (*v.* Fig. 223). If the uterine orifice is sufficiently dilated, the

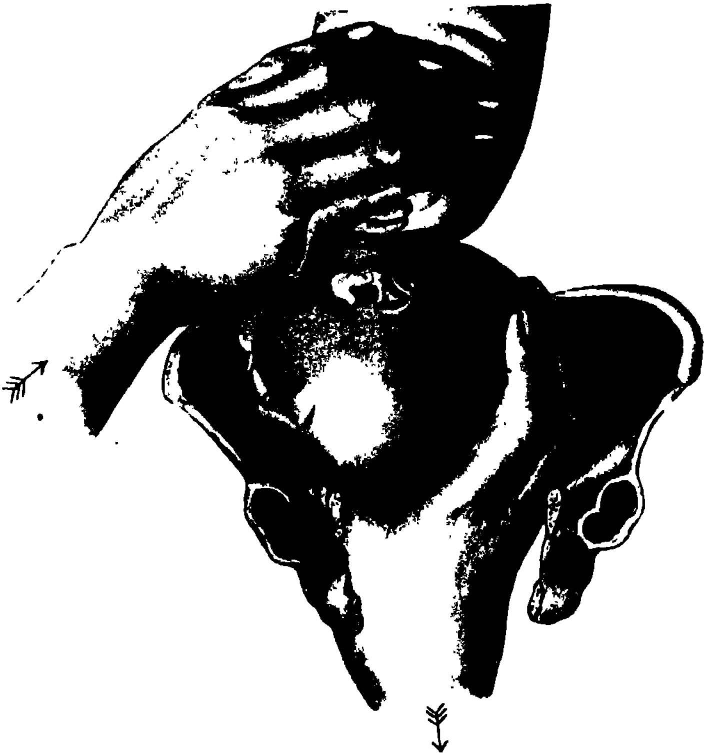

Fig. 224.—The Playfair-Partridge Method of converting a Face Presentation into a Vertex.

The right hand on the uterus draws the occiput downwards, while the left hand on the abdominal wall pushes the shoulder in the direction of the back.

whole hand may be passed into the uterus, and the face grasped and pushed upwards out of the brim before endeavouring to obtain flexion. This procedure is especially necessary in cases where the face is fixed. The performance of Baudelocque's method may be facilitated by the adoption of an expedient introduced by Ziegenspeck,* by which an assistant presses the shoulders in the direction of the child's back and the breech in the opposite direction, as in Schatz' method, while at the same time the operator carries out the procedure just described.

(2) *The Playfair-Partridge Method.*†—For the performance of this method the uterine orifice must be sufficiently dilated to admit the hand, and the patient, as before, must be under an anæsthetic. The patient is placed in the dorsal position and the operator introduces into the vagina the hand corresponding to the side towards which the occiput is turned. Then, passing the hand into the uterus and above the occiput, he grasps the latter and draws it downwards, while with the external hand he pushes the chest of the fœtus upwards and in the direction of the back (*v.* Fig. 224).

A few words of warning must be given regarding the performance of either of the foregoing methods. In every case particular attention must be directed to ensuring that, whatever method is adopted, flexion is complete, and that the anterior fontanelle lies at a higher level than the posterior. There is always a risk in these cases that the pre-existing face presentation may be converted into a brow presentation, and, as we shall see presently, this would be a most unfortunate occurrence and one which would make the prognosis of the case considerably worse.

Podalic Version.—There is another line of treatment in a face presentation which must also be considered. A face presentation may be turned into a pelvic presentation by performing the operation known as version. A pelvic presentation is more dangerous for the infant than is a vertex, but it is considerably less dangerous for both mother and infant than is a face, and, accordingly, under certain circumstances it may be advisable to perform version in face presentation.

We must now decide on what we consider the most suitable treatment to adopt in cases of face presentation. If the case is seen in sufficient time to perform Schatz' method, there is no doubt that it should be attempted. If it fails and if the chin is directed anteriorly the presentation may be left unchanged, as it will almost certainly be delivered spontaneously. If, on the other hand, the chin is directed posteriorly, either Baudelocque's or Partridge's method should be adopted, and a vertex presentation substituted for the face. If they fail, or if, after having procured a vertex presentation, the face presentation recurs, we may turn the fœtus by external version. If, on the other hand—as usually is the case—the face is fixed in the brim before its nature is recognised, the presentation may be allowed to persist, and in all probability delivery will occur spontaneously.

If the presentation is allowed to persist the important points in the conduct of the case are as follows:—The patient should be kept in bed during the latter half of the first stage, especially if the membranes are bulging unduly through the os externum, in order to avoid their rupture. During the second stage, she should lie on the side to which the chin is turned, as this favours its anterior rotation. As the head approaches the perinæum a vaginal examination must be made, to determine whether anterior rotation of the chin is occurring. If it is not doing so, an attempt should be made to convert the face into a vertex by Baudelocque's or Partridge's method, or, if they fail, anterior rotation may be assisted by pressing the forehead upwards with the fingers in the vagina during several contractions, as this retards the descent of that part, and, by causing the chin to become lowest, favours its anterior rotation. If rotation still does not occur, or if posterior rotation of the chin occurs, place the patient under an anæsthetic, and, introducing the hand into the vagina, grasp the face and endeavour to rotate it so as to bring the chin forward by the shortest route. This procedure may be assisted by at the same time pressing the anterior shoulder to the front with the hand upon the abdomen. If this fails the forceps may be tried, provided that the chin has not rotated into the hollow of the sacrum. If the forceps fails, or if the chin had already rotated posteriorly, the head must be perforated.

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* 'Beiträge zur Behandlung der Gesichtslagen.'

† *New York Med. Journ.*, March, 1887, and *Amer. Journ. of Obstet.*, 1884, p. 593.

Prognosis.—The prognosis in face presentation is more serious for both the mother and the fœtus. In the case of the mother this is accounted for by the long duration of labour and by the internal manipulations which are usually necessary. In the case of the fœtus the mortality has been estimated at 13 per cent. by some, by others (Galabin) at 8·4 per cent. This is due in part to the long labour, and in part to the stretching and compression of the neck which results from the over-extension of the head.

In all cases, the friends of the patient must be warned beforehand that labour will be tedious, and that in all probability there will be considerable temporary disfigurement of the fœtus.

BROW PRESENTATION

A brow presentation is the term applied to the presentation when the sinciput, or region of the head between the supra-orbital ridges and the anterior fontanelle, lies lowest (*v.* Fig. 225).

Frequency.—It is difficult to obtain any reliable figures to show the relative frequency of brow presentations. Some authors do not consider a brow presentation as a separate presentation, but term it a variety of face presentation, while others include in their figures all cases in which a brow presentation was recognised at any period of labour, and so, doubtless, include many cases of face presentation, as a brow presentation is of necessity a stage in every case of secondary face presentation. Perhaps, in compiling statistics, it would be best to include only those cases in which a brow presentation is recognised and changed, or passes through the brim as a brow presentation. The proportion of cases of brow presentation, estimating on this basis, is said to be about 1 in 500. At the Rotunda Hospital, amongst 19,293 cases, brow presentation occurred 30 times, or a proportion of 1 in

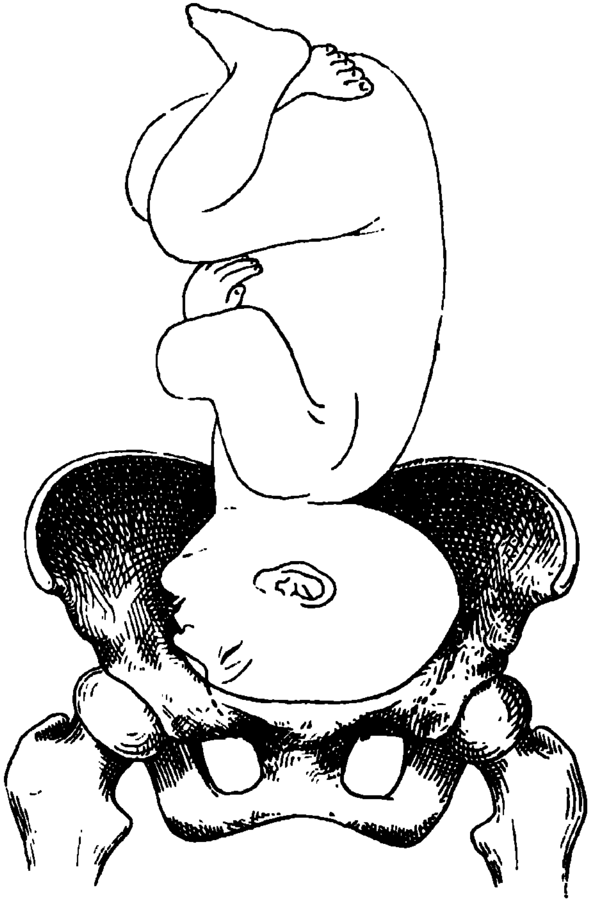

FIG. 225.—FIRST BROW PRESENTATION.

643·1. These figures contrast markedly with those of Guy's Hospital, where brow presentation was only observed 30 times amongst 49,145 deliveries,* or a proportion of 1 in 1,638. This is the more strange as apparently five sixths of these were cases which converted themselves into face presentations, and such cases are not included in the Rotunda figures.

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* Galabin, 'Manual of Midwifery,' fifth edition, p. 238

Ætiology.—A brow presentation is a stage between a face presentation and a vertex presentation. As is to be expected, the natural effect of the contractions of the uterus and of the resistance of the pelvic brim is to bring the head into a position of stable equilibrium either by causing full flexion and bringing the chin into apposition with the chest, or full extension and bringing the occiput into contact with the back. When a brow presentation occurs, the head is in a position of unstable equilibrium, midway between flexion and extension, and can only remain in this position so long as the forces to which it is subjected are equally distributed over its surface. Once the resistance offered to the descent of the occiput and vertex becomes greater than that offered to the face, extension occurs and a face presentation results, while, if the contrary happens, flexion occurs and a vertex presentation results. We may then consider as causes of a brow presentation the association of any factors which cause partial extension of the head with such a mutual adaptation between the shape and position of the head and the shape of the pelvis as will enable the head to maintain its position of unstable equilibrium between flexion and extension. The various factors which may produce partial extension are the same as those which may produce complete extension, and as they have been referred to when discussing the ætiology of face presentation they need not be again enumerated.

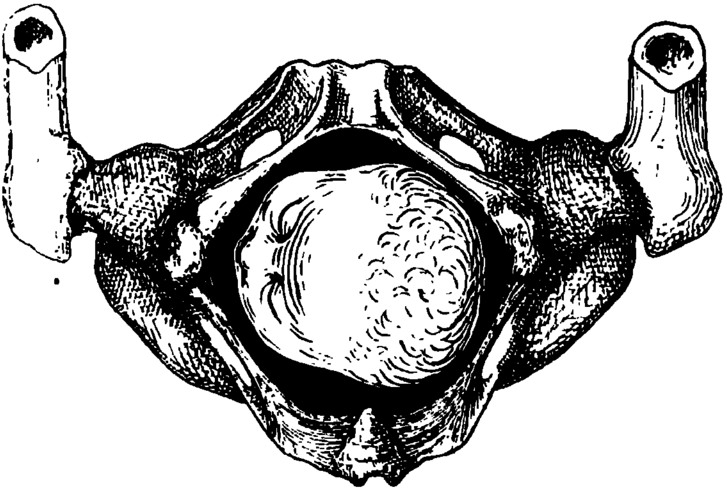

FIG. 226 FIRST BROW PRESENTATION.
The head presenting at the brim, as felt by vaginal examination.

Positions.—The fœtus can lie in one of two positions, according as the back is directed to the left or to the right. It is probable that, on account of the length of the engaging diameter of the head in this presentation, in all cases in which the head engages in the brim it does so with its supra-occipito-mental diameter in the transverse diameter of the brim. Accordingly, it is unnecessary to sub-divide each position according as the back is in front or behind, as is done in the case of the other presentations. The positions may, therefore, be tabulated as follows:—

First position, back to the left.

Second position, back to the right.

In all probability the first position is the more common.

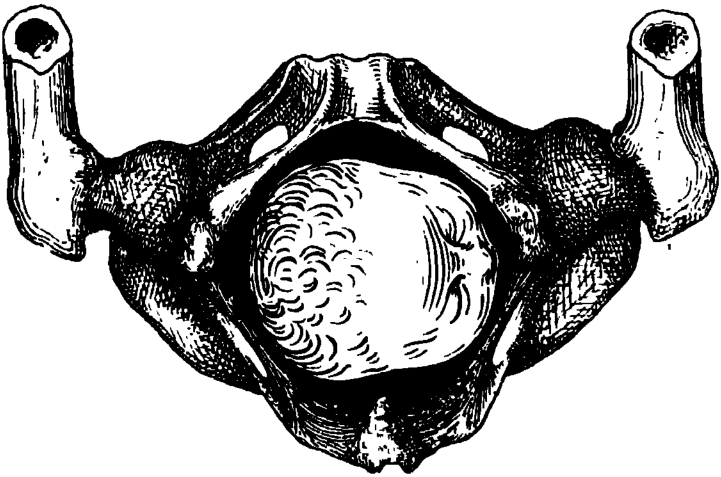

FIG. 227.—SECOND BROW PRESENTATION.
The head presenting at the brim, as felt by vaginal examination.

Diagnosis.—The diagnosis of brow presentation can be made by abdominal palpation and by vaginal examination; the assistance rendered by auscultation is but slight.

Abdominal Palpation.—The pelvic pole of the fœtus is found at the fundus. The lie is longitudinal, with the back directed to one or other side according to the position. The head occupies the lower segment of the uterus, and usually lies high above the brim, as the length of its engaging diameter obstructs its descent. The occipital tumour is more prominent than in a vertex presentation, but not so prominent as in a face presentation. It lies at the same level as does the chin, and the groove of the neck runs transversely across the uterus.

Vaginal Examination.—At the commencement of labour the head lies so high above the brim that it is difficult to reach the presenting part, and to enable us to do so the greater part of the hand must be passed into the vagina. The diagnosis of a brow is made by finding at one side of the pelvis the frontal bone, whose smooth and rounded surface resembles the contour of the vertex and is intersected by a suture, and on the other side the irregular outline of the supra-orbital ridges and the malar bones. If the membranes are intact they bulge through the uterine orifice, owing to the lack of accommodation between the head and the lower uterine segment. The position in which the fœtus lies can be determined by noting the side of the pelvis at which the anterior fontanelle lies.

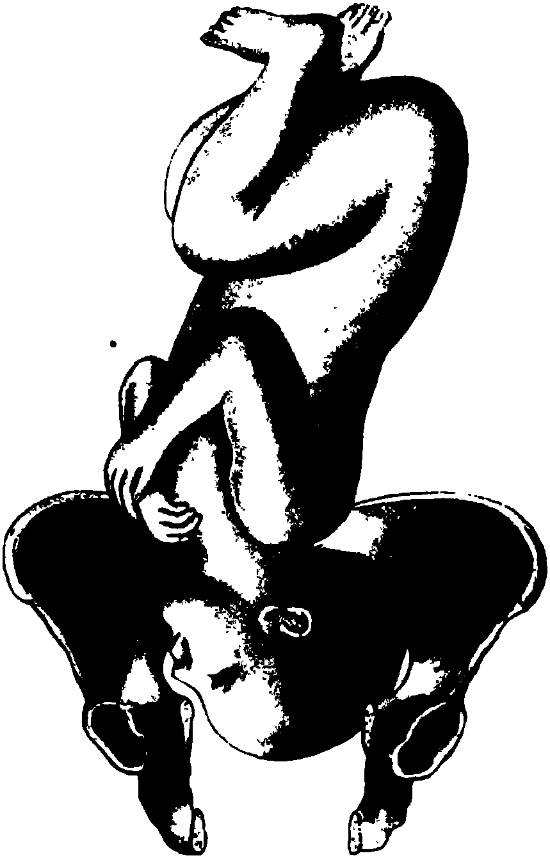

FIG. 228.—THE MECHANISM OF FIRST BROW PRESENTATION

The head presenting at the brim.

Auscultation.—The fœtal heart will probably be heard with difficulty, owing to the fact that the fœtal body lies more centrally in the uterus than in the other presentations. It will be heard best to ~~the left or~~ the right of the middle line, according as the fœtus lies in a first or a second position.

Mechanism.—When the brow presents at the pelvic brim, the greatest engaging diameters of the head are the supra-occipito-mental and the bi-parietal. The supra-occipito-mental diameter is, however, 5½ inches in length, while the length of the greatest diameter of the pelvis—*i.e.*, the transverse—is only 5¼ inches, consequently, in the case of a normally-sized fœtus and a normally-sized pelvis, the mechanism of labour in a brow presentation commences and ends by the fœtal head being driven into the brim and remaining there. If, however, the fœtus is small or macerated, or the pelvis very roomy, the head may be squeezed past the brim, after a considerable degree of moulding has taken place, with the supra-occipito-mental diameter corresponding to the transverse diameter of the pelvis. Four terminations of the case are then possible:—

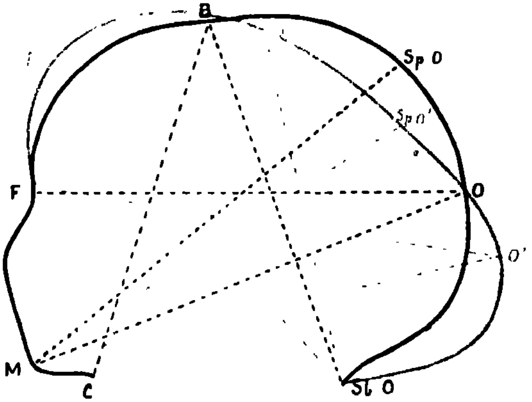

FIG. 229. THE MOULDING OF THE HEAD IN BROW PRESENTATION

The black outline represents the unmoulded, the red the moulded head. (Budin.)

(1) The brow presentation may persist and the head be expelled as such.

(2) The brow presentation may be changed into a face presentation as the head passes through the pelvis.

(3) The brow presentation may be changed into a vertex presentation.

(4) The head may become impacted in the pelvis.

If the brow presentation persists, internal rotation takes place in the usual manner, and brings the upper jaw behind the symphysis, and then the head, rotating round the fixed point of the jaw, is born by a movement of flexion. Restitution and the expulsion of the trunk follow in the usual manner. Sometimes, posterior rotation of the face may occur, but this so increases the already considerable difficulties of the case that the further expulsion of the fœtus is almost an impossibility.

Moulding.—The moulding of the head in cases which have been born as a brow presentation is extensive and characteristic. The main alteration is considerable flattening of the vertex, as a result of which the supra-occipito-mental and bi-parietal diameters are diminished, while there is a compensatory increase of the occipito-frontal, occipito-mental, and the sub-occipito-frontal diameters (*v.* Fig. 229). The caput succedaneum forms over the prominence of the forehead, and is of considerable size.

Management.—We have seen from the foregoing short account of the mechanism of labour in this presentation that it may be regarded as impossible for a full-sized fœtus to pass through a normally-sized pelvis with the brow presenting. We have also seen that, if in the case of a small fœtus the head does pass through the brim, the presentation may become altered in the pelvic cavity into either a face or a vertex. Accordingly, we have got a very clear indication of what the treatment of the presentation ought to be. If a brow presentation is found at the pelvic brim, it must under no circumstances be allowed to persist. It is always possible to alter it when in this position, unless labour has advanced so far that rupture of the uterus is feared, and in such cases perforation must be performed. If the head has passed into the pelvic cavity, we must also endeavour to correct the presentation. But if we fail to do so, we need not give up all hope of saving the fœtus, as the head may be expelled by the natural efforts. In such cases the patient should lie on the side to which the face is turned, as this favours its anterior rotation. If the head still does not advance, and the indications of unduly prolonged labour appear, we may attempt to deliver the fœtus with the forceps. Occasionally, the fœtus may be extracted in this way, but perhaps more usually the forceps will fail to effect delivery, and perforation will be necessary. As a rule, the fœtus will be afforded the best chance of life by leaving delivery to the natural efforts for as long as possible. The forceps tends to impact the head in the pelvis, and to prevent the spontaneous correction of the presentation which might have otherwise occurred. Its application should therefore be postponed for as long as possible, and then only resorted to as a last chance prior to perforation.

A brow presentation may be converted into either a face or a vertex, according as complete extension or complete flexion of the head is brought about. If we decide on attempting to bring about a vertex presentation, our procedure is identical with that which has been recommended in the case of a face presentation. If the head is free above the brim and the membranes intact, Schatz' method may be tried (*v.* Figs. 219-221), and if this is unsuccessful or impossible, Baudelocque's or the Playfair-Partridge method should be attempted (*v.* Figs. 222, 223). If the head has descended too deeply into the pelvis to allow a vertex presentation to be produced, an attempt may be made to produce a face presentation. To do this, we press upwards at each side of the large fontanelle, during a contraction, with the fingers in the vagina, while at the same time the other hand on the abdominal wall endeavours to press the chin downwards. This procedure is but rarely successful, but inasmuch as it does no harm, and as it may succeed, it is permissible to try it.

If the head is free above the brim, but it is impossible to obtain or to maintain a vertex presentation, podalic version should be performed and a pelvic presentation obtained.

Prognosis.—The prognosis in a brow presentation is bad for the fœtus and more serious for the mother than in either face or vertex presentation, a fact which is readily accounted for by the prolonged labour and the amount of manipulation which is usually necessary.

ANTERIOR FONTANELLE PRESENTATION

An anterior fontanelle presentation is the term applied to the presentation when the head lies in a position midway between a vertex presentation and a brow presentation and the anterior fontanelle lies lowest (*v.* Fig. 230).

Ætiology.—There are two very different causes of anterior fontanelle presentation; the first of these is an unduly large pelvis, and the second a flattened pelvis. The former tends to cause an anterior fontanelle presentation owing to the slight resistance it offers to the descent of the fœtal head. As we have already mentioned, the degree of flexion of the head which occurs is an index of the amount of resistance which is offered to the head in its passage through the pelvis. In a normal case, this resistance is sufficient to produce a vertex presentation, which alters to a presentation of the posterior fontanelle as the head passes through the pelvic cavity. In the case of a generally contracted pelvis, as we shall see in a short time, the resistance is sufficient to produce a presentation of the posterior fontanelle even while the head is at the brim, or in some cases a presentation of the occipital bone. Accordingly, it is not strange that if the resistance to the descent of the head is slight, the head may pass through the brim in an insufficiently flexed position—*i.e.*, as an anterior fontanelle presentation. The manner in which this presentation is produced in a flattened pelvis is very different. Owing to the shortening of the oblique and conjugate diameters, the head engages in the pelvis with its antero-posterior diameters corresponding to the transverse diameters of the brim. Then, as a result of the greater resistance which is offered to the passage through the brim of the bi-parietal diameter than of the bi-temporal diameter, the sinciput descends more rapidly than the vertex, and the anterior fontanelle becomes the presenting point. It must also be mentioned that presentation of the anterior fontanelle may occur when the head is deep in the pelvic cavity. Such cases are associated with a posterior rotation of the occiput in a vertex presentation, and cannot strictly be included under the head of anterior fontanelle presentations.

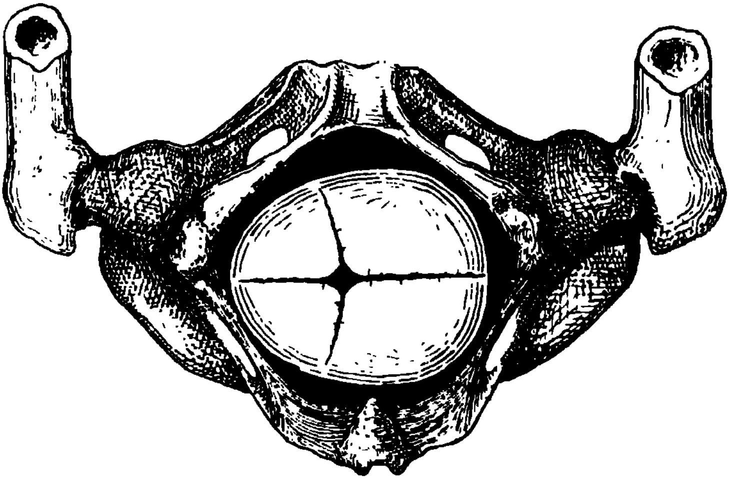

FIG 230 —FIRST ANTERIOR FONTANELLE PRESENTATION

The head presenting at the brim, as felt by vaginal examination.

Positions.—Two positions are met with :—

First position, back to the left.

Second position, back to the right

Diagnosis.—The difference between the position of the head of the fœtus in this position and in vertex presentation is not sufficiently marked to enable the nature of the case to be diagnosed by abdominal palpation, nor will auscultation give any definite information. We therefore rely entirely upon vaginal examination. By this means, we find the head presenting, and the anterior fontanelle lying lowest and almost in the centre of the pelvic brim. In cases where there is an accompanying Naegele's obliquity of the head, the fontanelle will lie nearer the promontory than the symphysis.

Mechanism.—In cases in which the presentation is due to the existence of a flat pelvis, the head engages with its occipito-frontal diameter in the antero-posterior diameter of the pelvis. In consequence of the resistance offered by the narrow conjugate to the passage of the bi-parietal diameter, the head glides towards the side at which the occiput lies, and so a narrower diameter than the bi-parietal is brought into the conjugate diameter. At the same time, a varying degree of Naegele's obliquity is produced (*v.* Fig. 187). The contractions of the uterus continuing, the head is driven through the brim, if the disproportion is not too great. Then, as a rule, the usual degree of flexion of the head occurs, and the remainder of the mechanism is similar to that of a vertex presentation.

In cases in which the presentation is not associated with contracted pelvis, the head passes through the brim in the usual manner, save that the anterior fontanelle presents. Then, on reaching the pelvic floor, in consequence of the incomplete flexion of the head, the sinciput may rotate beneath the pubis. In such cases, the remainder of the mechanism is similar to that of a vertex in which the occiput has rotated posteriorly.

Management.—The presence of an anterior fontanelle presentation does not in itself necessitate any interference with the course of labour, as it is but rarely that the presentation occurs save when it is suitable, as in flattened pelves, or when the pelvis is very roomy. As, however, it is usually associated with a lack of adaptation between the presenting head and the lower uterine segment, and so with a tendency to premature rupture of the membranes, the patient should be kept in bed during the first stage. In a case of flattened pelvis, she should at first lie upon the side towards which the sinciput is directed; and then, as soon as the head has passed the brim, upon the opposite side, in order to promote the descent of the posterior fontanelle.

Prognosis.—The prognosis of the case for both mother and child depends on the cause of the presentation, and, in the case of a flattened pelvis, on the degree of contraction present. If the presentation persists and the occiput rotates posteriorly, the prognosis of the case is perhaps slightly more unfavourable than in a vertex presentation.

POSTERIOR FONTANELLE PRESENTATION.

A posterior fontanelle presentation is the term applied to the presentation when the head lies in a fully flexed position, the posterior fontanelle lying lowest (*v.* Fig. 231). This condition is also known as Roederer's obliquity.

Ætiology.—As has been already mentioned, the degree of flexion which occurs is in proportion to the resistance offered to the passage of the head through the brim. Consequently, presentation of the posterior fontanelle will be expected when the resistance to the descent of the head is greater than normal. This occurs in a generally contracted pelvis, or in the case of an unduly large fœtal head. It must also be mentioned that presentation of the posterior fontanelle occurs in the ordinary mechanism of a vertex presentation after the head has passed through the brim, but such cases are classed as vertex presentations.

Positions.—Two positions are met with, according as the back lies on the left or on the right:—

First position, back to the left

Second position, back to the right

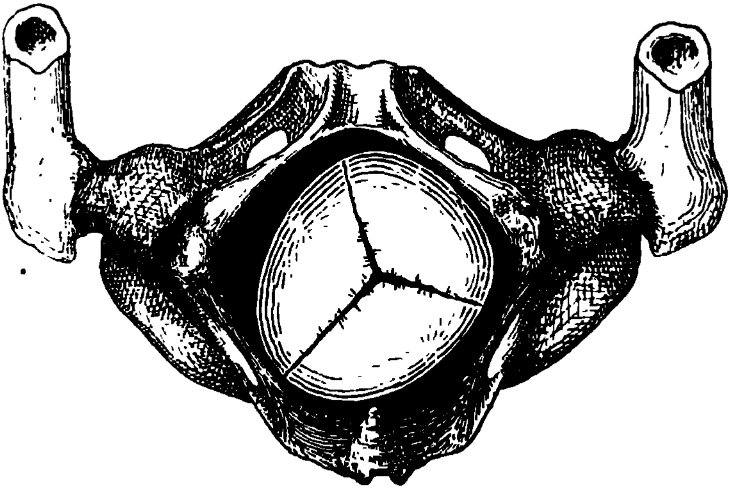

FIG. 231.—FIRST POSTERIOR FONTANELLE PRESENTATION

The head presenting at the brim, as felt by vaginal examination.

Diagnosis.—As in the case of anterior fontanelle presentation, the diagnosis can only be made by vaginal examination. By this means the head is found presenting, and the posterior fontanelle constituting the presenting point.

Mechanism.—The head first presents at the brim with its occipito-frontal diameter corresponding to the oblique diameter of the pelvis. As the contractions continue, flexion becomes more marked than normal owing to the resistance offered to the descent of the sinciput by the pelvic inlet, and the posterior fontanelle becomes the presenting point, even though the head has not yet entered the brim. In some cases, flexion may even proceed so far that the occipital bone lies lowest, thus giving rise to the so-called occipital presentation. If the head passes through the brim, the remainder of the mechanism of the case is similar to that of a vertex presentation.

Moulding.—The occipito-mental diameter of the head is considerably elongated, so that the head presents the appearance of having been drawn out. The occipito-frontal and sub-occipito-bregmatic diameters are shortened. The caput succedaneum is formed round the posterior fontanelle and in part on the occipital bone, and is usually of large size.

Management.—If the posterior fontanelle is found presenting at the brim, we must endeavour to determine the cause. If the pelvis is generally contracted, the treatment proper to the degree of contraction must be adopted. If the degree is not too great to allow the passage of the head, the presentation of the posterior fontanelle may be encouraged, as it is most suitable in such cases. To this end, the patient lies on the side towards which the occiput is turned. If there is no pelvic contraction present, the head must be allowed to mould until indications necessitating the delivery of the patient occur. Then, an attempt may be made to deliver by means of the forceps, but if this fails perforation will be necessary

Prognosis.—The prognosis depends upon the cause of the condition, and in the case of contracted pelvis upon the degree of contraction. The accurate manner in which the head fits the pelvic brim in cases of generally contracted pelvis may lead, in cases in which labour is prolonged, to considerable necrosis of tissue as a result of pressure For the same reason, there is sometimes so marked pressure upon the ureters as to cause obstructive suppression of urine, and so to favour the occurrence of eclampsia.

CHAPTER VI

PELVIC PRESENTATION

Complete Pelvic Presentations—Incomplete Pelvic Presentations—Frequency—Ætiology—Positions—Diagnosis—Mechanism—Abnormal Mechanism, Reversed Rotation of Head—Management—Prognosis.

The term 'pelvic presentation' is used to include all presentations in which the lower pole of the fœtus presents. In consequence of the different attitudes which the fœtus may assume, the following divisions and subdivisions of the presentation must be made:—

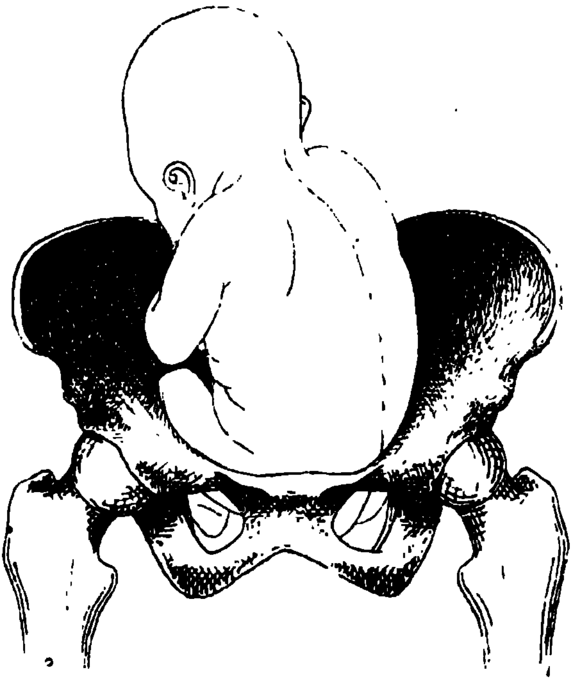

FIG. 232.—FIRST PELVIC PRESENTATION, THE BACK IN FRONT.

(1) Complete Pelvic Presentation.—In this, the fœtus preserves its normal attitude, and, consequently, the breech and feet are found at the brim, and pass through the pelvis together (v. Fig. 232).

(2) Incomplete Pelvic Presentation.—Any variation from the normal attitude of the fœtus will cause an incomplete pelvic presentation. Thus, the legs may be fully extended at both hip and knee, and so the feet present; or, they may be flexed at the hips, but extended at the knees, and so the breech alone present; or the reverse may happen, the thighs being extended, and the lower legs flexed, so causing a knee presentation; or, lastly, any combination of these conditions may occur, one leg, for instance, being fully extended, the other fully flexed, or flexed at the hip and extended at the knee. The terms to be used to describe these variations of an incomplete pelvic presentation are not very accurate, nor are they in all cases used by different authorities in the same sense. The term 'breech presentation' should be reserved for cases in which the breech alone presents, the thighs being flexed on the abdomen and the lower legs extended. Here we use it in this sense alone, but many writers use it as an inclusive term for any form of pelvic presentation. The term 'foot presentation' includes all cases in which one or both feet present; and the term 'knee presentation' includes all cases in which one or both knees present. Accordingly, we shall divide incomplete pelvic presentations into the following groups:—

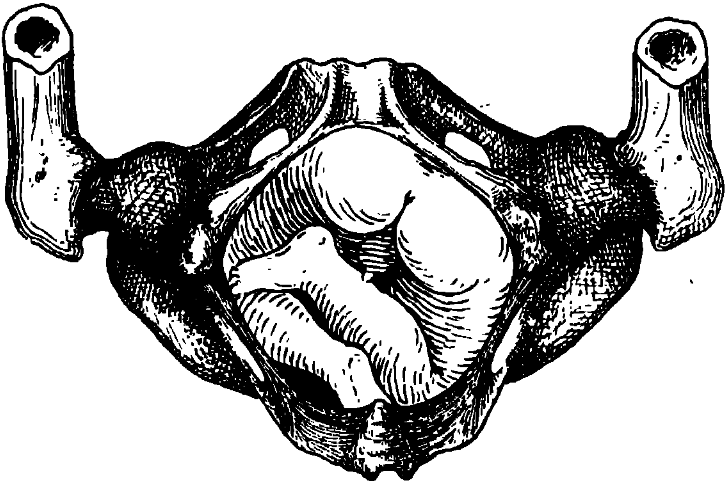

Fig. 233.—First Pelvic Presentation, with the Back in Front

The breech presenting at the brim, as felt by vaginal examination

(a) Breech Presentation.—The breech alone presents, the thighs being flexed on the abdomen and the legs extended.

(b) Foot or Footling Presentation.—One or both thighs and legs are fully extended, so making one or both feet the presenting part (v. Fig. 234).

(c) Knee Presentation.—One or both thighs are extended, the legs being flexed, so making one or both knees the presenting part.

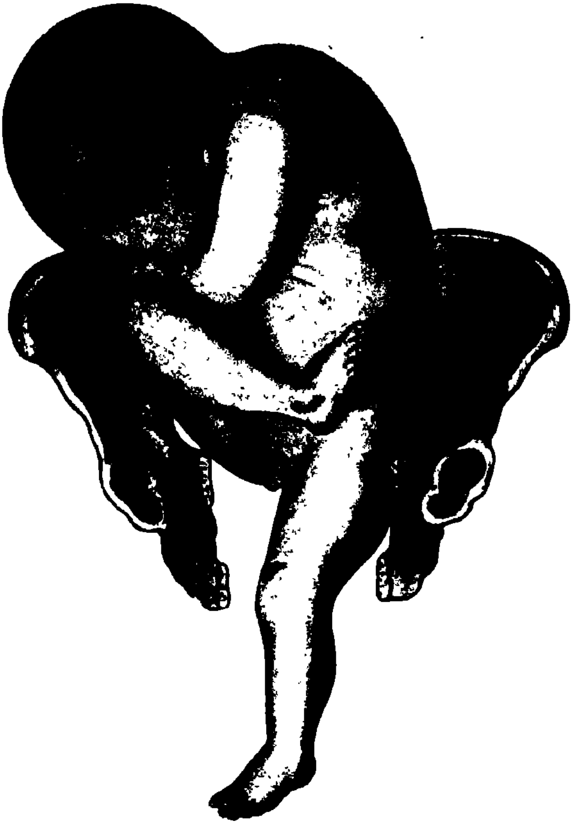

FIG. 234.—A FOOTLING PRESENTATION.

Frequency.—The relative frequency of pelvic presentation is affected to a marked extent by the period of pregnancy at which delivery takes place, and by the number of children the woman has previously borne. As has been already pointed out, towards the end of the first half of pregnancy the tendency of a fœtus is to present by its pelvic pole, on account of the better adaptation which then results between the fœtus and the uterus. In the later months, on the other hand, for the same reason pelvic presentation but rarely occurs, and then only as the result of some interference with the conditions which normally cause a head presentation. Thus, Pinard found among 100,000 cases of labour, in which all deliveries were included independent of the period of pregnancy at which they took place, 3,301 pelvic presentations, or a proportion of about 1 in 30. When, however, he excluded all premature and immature cases, the proportion dropped to 1 in 62. The effect of primiparity or multiparity upon the proportion is not so marked, but still is usually considered to be considerable. The statistics of Winckel show that the proportion of pelvic presentations amongst primiparæ is about 1 in 80, and amongst multiparæ about 1 in 23; and most other writers, though they may not consider the difference to be so marked, still consider that multiparity is a predisposing cause. Accordingly, the statistics furnished by Lepage* from the Clinic Baudelocque come as somewhat of a surprise. During a fixed period he found

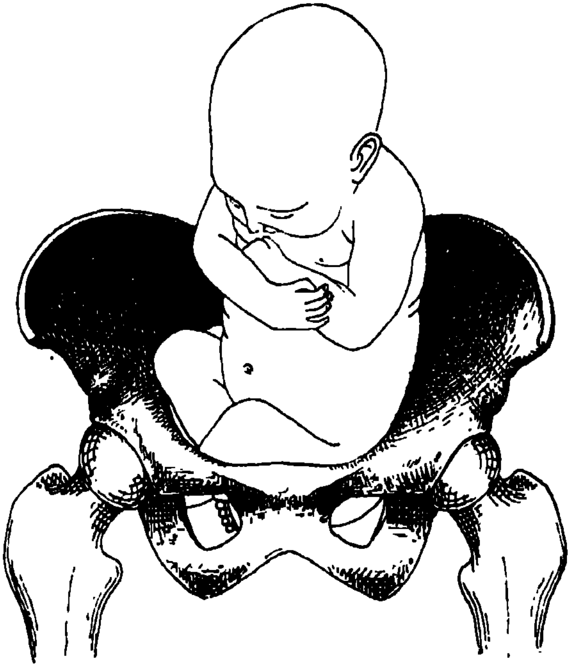

FIG. 235. FIRST PELVIC PRESENTATION, THE BACK BEHIND. (Farabœuf)

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* 'Précis d'Obstétrique,' p. 446.

102 pelvic presentations occurring in primiparæ, and 72 in multiparæ. He does not tell us the exact number of primiparæ and multiparæ which were confined, but merely states that there were a greater number of multiparæ. These figures would suggest that only primiparæ whose pregnancy had been pathological or who suffered from a contracted pelvis were admitted into the clinic.

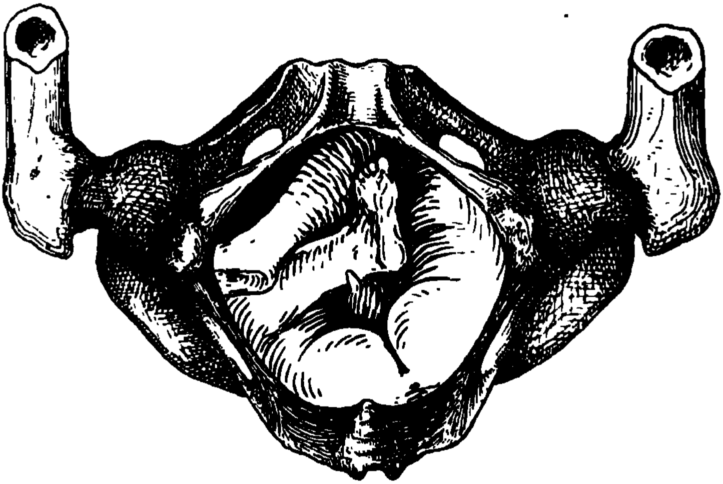

FIG. 236.—FIRST PELVIC PRESENTATION, WITH THE BACK BEHIND.
The breech presenting at the brim, as felt by vaginal examination.

The following table shows the relative frequency of pelvic presentation at the different months of pregnancy :—*

Month.	Number of Pelvic Presentations.	Number of Vertex Presentations.	Percentage of Pelvic Presentations.
Fifth - - -	5	4	55·5
Sixth and seventh	8	17	32·0
Eighth and ninth	6	73	7·6
Tenth - - -	9	203	4·25
Full term - -	27	1,681	1·5

The relative frequency of the different varieties of pelvic presentation is more difficult to ascertain, inasmuch as in many lists of statistics they are not taken into account, all cases being merely classed as pelvic presentations. At Guy's Hospital complete pelvic presentation and breech presentations, grouped together, occurred once in 58 labours and constituted 68 per cent. of all pelvic presentations, while knee and foot presentations, taken together, occurred once in 121 presentations. Lepage's statistics, to which we have already referred, give the following figures :—

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* Winckel, 'Text-Book of Midwifery,' p. 173

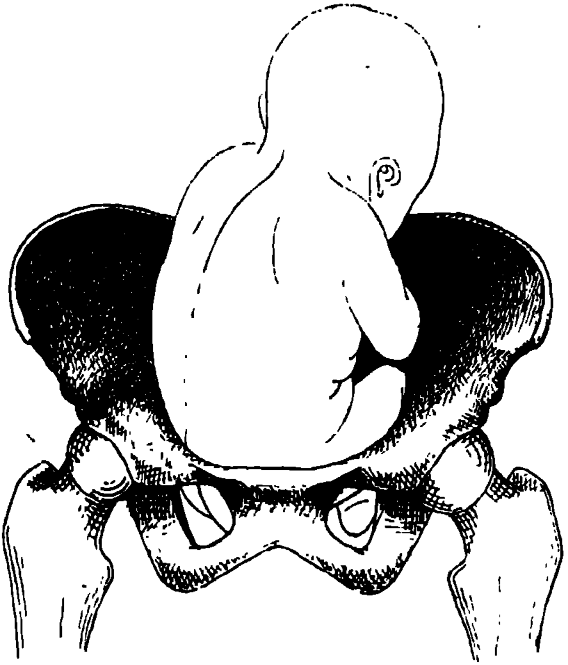

FIG. 237.—SECOND PELVIC PRESENTATION, THE BACK IN FRONT. (Farabeuf.)

	Primiparæ.	Multiparæ.
Total number of pelvic presentations	102	72
Complete presentations	28	27
Incomplete presentations	74	44
Breech presentations	71	36
Foot presentations	3	7
Knee presentations	—	1
Unknown presentations	—	1

The statistics of the Rotunda Hospital show that amongst 19,293 confinements, in which all cases of labour, save abortions, are included, pelvic presentation occurred 677 times, or a proportion of 1 in 28·5.

Ætiology.—We have already seen, when discussing the causes of the overwhelming proportion of cephalic over pelvic presentation, that the associated causes which produce cephalic presentation are three in number:—

(1) The relation between the shape of the fœtus and the shape of the uterus.

(2) The effect of gravity upon the fœtus.

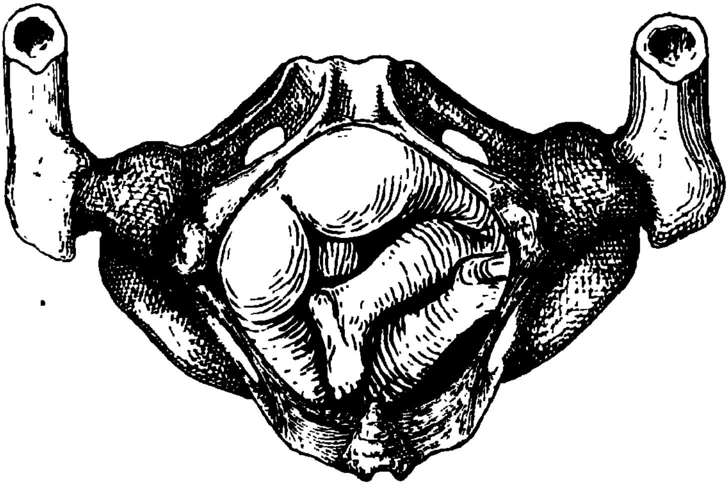

FIG. 238.—SECOND PELVIC PRESENTATION, WITH THE BACK IN FRONT.

The breech presenting at the brim, as felt by vaginal examination.

(3) The movements of the fœtus.

Accordingly, we may now expect to find that pelvic presentation may be caused by certain alterations in these causes, and experience shows that this is so. The causes of pelvic presentation may be divided into three groups:—

(1) Alterations in the normal relation between the shape of the fœtus and the shape of the uterus.

(2) Alterations in the effect of gravity upon the fœtus.

(3) Cessation of the fœtal movements.

In the first of these groups, we must place all conditions which tend to make the capacity of the pelvic pole of the uterus equal to or greater than its fundal pole, and all conditions which make the cephalic pole of the fœtus equal to or greater than its pelvic pole. These causes are as follows:—

(*a*) *Causes which Affect the Uterus.*—Multiparity, by causing a large lax uterus; tumours of the uterus; over-distension, as in twins or hydramnios; contracted pelvis, by preventing the head from descending and adapting itself to the lower pole of the uterus; placenta prævia, by acting in a similar manner to the foregoing; congenital malformations of the uterus.

(*b*) *Causes which Affect the Fœtus.*—Hydrocephalic head, by making the cephalic pole larger than the pelvic; cystic enlargement of the upper portion of the fœtal body; premature or macerated fœtus.

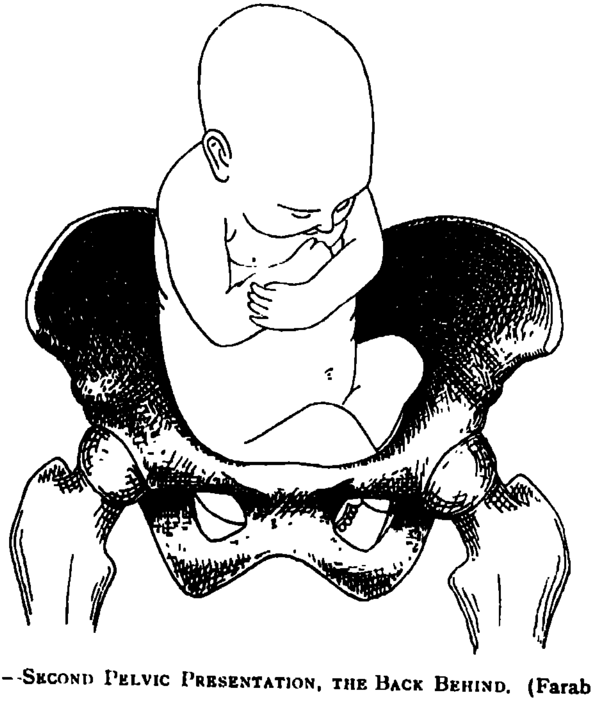

FIG. 239.—SECOND PELVIC PRESENTATION, THE BACK BEHIND. (Farabœuf.)

In the second main group of causes of pelvic presentation, we must place a few conditions which so alter the fœtal body that the pelvic pole is heavier than the cephalic. The principal of these causes are premature and macerated fœtus in which the specific gravity of the head is diminished relatively to that of the breech; and cystic enlargement of the fœtal bladder or kidneys.

In the third main group of causes, only one condition is to be found, and that is a dead fœtus, owing to the absence of the movements of the limbs which tend to produce a cephalic presentation.

The principal cause of a foot or a knee presentation is stated to be an oblique lie of the fœtus prior to the onset of labour. If in such a case the cephalic pole of the fœtus lies lower than the pelvic pole, an arm tends to prolapse; if the pelvic pole is the lower, a leg (Herman).

Positions.—The fœtus may lie in one of two positions according as the back is turned to the left or to the right side, and each of these positions may be again sub-divided into two more according as the back is directed anteriorly or posteriorly. The different positions may be tabulated as follows:—

First position, back to the left	In front, first position of Naegele, sometimes termed left sacro-anterior, or L.S A.
	Behind, fourth position of Naegele, left sacro-posterior, or L.S.P.
Second position, back to the right	In front, second position of Naegele, right sacro-anterior, or R S A.
	Behind, third position of Naegele, right sacro-posterior, or R.S.P.

If Naegele's classification is adopted the sacrum is used as the indicator, as is the occiput in vertex presentation, or the chin in face presentation. The first position is slightly more common than the second, and the back is usually directed anteriorly. Amongst 284 cases recorded at different times by Winckel[*] and Hecker, the first position occurred 155 times and the second position 129 times, or a proportion of 1·2 to 1 in favour of the first position. This is very different from the relative frequency of the two positions found in vertex presentation, in which, according to Winckel,[†] the proportion of the first position to the second is as 64·7 to 35·3, or, roughly, as 9 to 5. This relative equality in the frequency of the two positions in pelvic presentation is probably due to the fact that here one of the important causes of the high proportion of first position in vertex presentation is wanting. The right oblique diameter of the pelvis is longer than the left, and, consequently, in vertex presentation the longer engaging diameter of the head—*i.e.*, the occipito-mental diameter—finds more room in it than in the left oblique diameter. In the first position in pelvic presentation, on the other hand, the long diameter of the pelvic pole of the fœtus—*i e.*, the bi-trochanteric diameter—has to lie in the left oblique diameter of the pelvis, *i.e.*, in the shorter of the two diameters.

Diagnosis.—The diagnosis of pelvic presentation can be made by abdominal palpation, vaginal examination, and auscultation.

Abdominal Palpation.—The cephalic pole of the fœtus is found at the fundus of the uterus and is recognised by the following signs:—

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[*] *Op cit.*, p. 170.

[†] *Ibid.*, p. 154.

(1) The head is more round, more uniform in outline, and firmer than the breech.

(2) It is also more movable, and can be ballotted from side to side if the membranes are intact.

(3) It is separated from the back by a deep groove—the groove of the neck.

Of the three signs the determination of the groove of the neck is the most important.

The lie of the fœtus is found to be longitudinal, with the back directed to one or other side, according to the position. The pelvic pole is found in the lower pole of the uterus, if it has not passed through the brim. If it can be palpated it is distinguished from the head by its greater size, by the presence of the thighs, by the absence of the groove of the neck, and by the impossibility of obtaining ballottement. The feet can sometimes be felt lying at or near the pelvic brim.

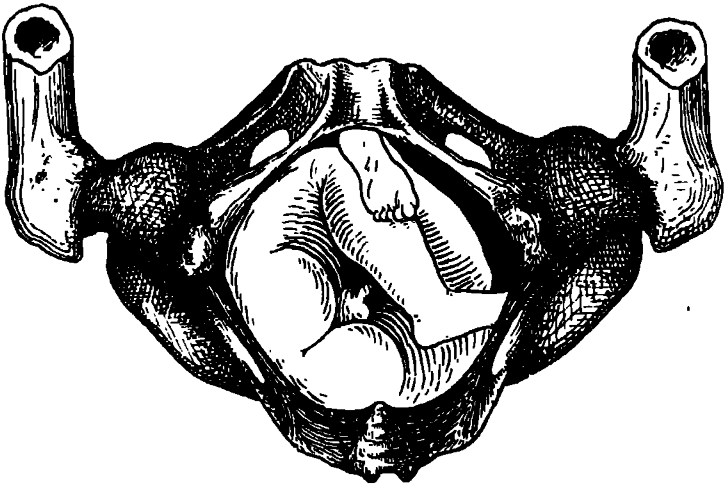

FIG. 240.—SECOND PELVIC PRESENTATION, THE BACK BEHIND.

The breech presenting at the brim, as felt by vaginal examination.

Vaginal Examination.—At the commencement of labour it may be difficult to reach the presenting part owing to its high situation, but as it descends, its nature can be determined. The diagnostic points are the tuberosities of the ischium and the tip of the coccyx, the groove of the nates, the anus, and the external genitals. The anus may be mistaken for the mouth, and can be distinguished from the latter as has been already mentioned. In some cases, where labour has lasted for a considerable time and a large caput succedaneum has formed on the presenting part, there may be some difficulty in distinguishing between a face and a breech. If, however, the fingers are passed upwards beside the presenting part a diagnosis will readily be made, as in the case of a face we shall come upon the ear, in the case of a breech upon the groove between the thighs and the trunk and upon the crest of the ilium. If a limb, or any part of one, is found in the vagina, we must determine first what limb or part of one it is, and, secondly, to what side it belongs. We have already mentioned the diagnostic points, but it may be well to repeat them.

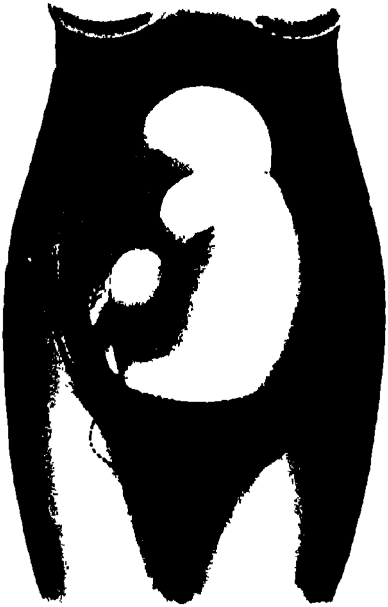

FIG. 241.—DIAGRAM REPRESENTING THE FŒTUS AS FELT BY ABDOMINAL PALPATION IN PELVIC PRESENTATION.

The unshaded portions of the fœtus are those that are felt most distinctly.

A hand is relatively smaller than a foot, the outline of the tops of the fingers is curved, and the thumb can be apposed and opposed to the palm. In a foot, on the other hand, the outline of the tops of the toes is straight, the articulations of the great-toe do not permit any lateral movement, and the shape of the os calcis and its relation to the malleoli are quite characteristic. The elbow is relatively smaller than the knee, the olecranon process is immobile, while the patella can be moved if the knee is not strongly flexed. Further, in the case of the knee, the patellar ligament and the tuberosity on the tibia can be felt. The side to which a foot belongs—*i.e.*, whether it is right or left—can readily be determined by inspection if the foot has passed outside the vagina. If it is still in the vagina, the side can be determined by noting the position which the great-toe occupies upon it, and then mentally comparing it with the position the great-toe occupies respectively on a right or left foot. A complete pelvic presentation is diagnosed by finding the feet lying beside the breech; a breech presentation by finding the breech alone; and a foot or a knee presentation by finding respectively the foot or the knee lying lowest.

The position of the fœtus can be determined by noting the side of the pelvis at which the coccyx or the external genitals are found.

Auscultation.—At the commencement of labour, before the breech has descended into the pelvis, the heart is heard slightly above the umbilicus and to one or other side of the uterus, according to the side to which the back is turned. As the breech descends, it is heard at a correspondingly lower level.

Mechanism.—The mechanism of a pelvic presentation differs in one important detail from the mechanism of a cephalic presentation, in that the movements of flexion and extension, which are of such importance in the latter presentation, are in pelvic presentation of necessity absent. As the breech and trunk already constitute a single and more or less rigid body, there is no necessity for the initial movement by which, in cephalic presentation, the head and trunk are temporarily brought into rigid coaptation, and, consequently, in a pelvic presentation, there is no analogue to the inital flexion or extension of cephalic presentation. For the later extension or flexion, by which the head follows the curve of the genital canal and passes through the vulva, there is an analogue in pelvic presentation, inasmuch as the curve of the pelvis must be followed, and this is found in a latero-flexion of the body of the fœtus in a direction corresponding to the pelvic curve. Similarly, internal rotation occurs in pelvic as in cephalic presentation in order to maintain the long diameters of the fœtal pelvis in the long diameters of the maternal pelvis, and results in the rotation of the bi-trochanteric diameter of the fœtus from one or other oblique diameter into the antero-posterior diameter of the maternal pelvis. Lastly, external rotation occurs as before, in consequence of internal rotation of the shoulders. We shall now describe these various movements in greater detail.

Descent.—Under the influence of the uterine contractions the pelvic pole of the fœtus descends into the pelvic brim of the mother, the bi-trochanteric diameter corresponding to one of the maternal oblique diameters (*v.* Fig. 242). If it is a case of complete pelvic presentation, the pre-existing flexion of the lower limbs is increased, and the latter are pressed strongly against the fœtal body. In some cases, the feet may catch against the brim and be pushed upwards as the breech descends, the presentation thus being converted from a complete pelvic presentation to a presentation of the breech alone. As the breech passes into the pelvis, the anterior buttock lies at a slightly lower level than the posterior.

Internal Rotation.—As a result of its lower position, the anterior buttock reaches the pelvic floor first, and then, obedient to the rule of internal rotation, rotates in front, so that the bi-trochanteric diameter, which up to this corresponded to the oblique diameter of the pelvis, now corresponds with the antero-posterior diameter, and the anterior hip lies beneath the symphysis (*v.* Fig. 243). Internal rotation in a pelvic presentation never occurs through more than one-eighth of a circle, as no matter what the position of the fœtus, the anterior hip always rotates in front.

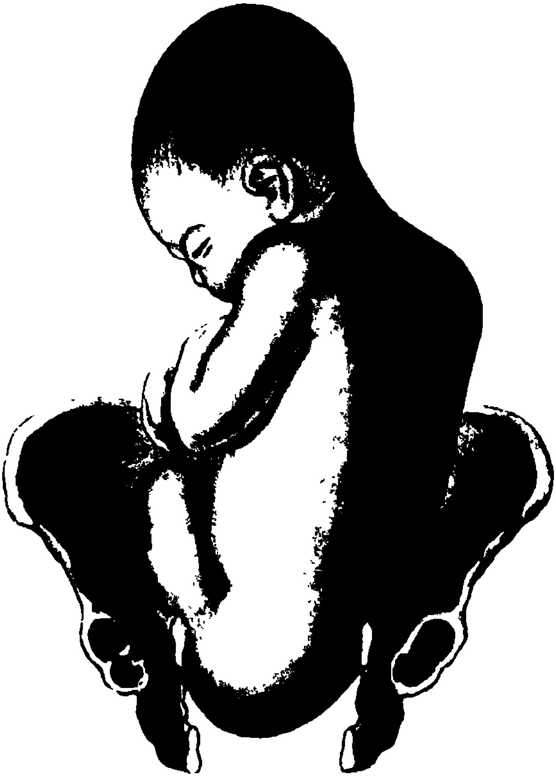

FIG. 242.—THE MECHANISM OF FIRST PELVIC PRESENTATION.
The pelvic pole engaging in the brim, its antero-posterior diameters corresponding to the left oblique diameters of the pelvis

Latero-flexion of the Trunk.—In order that the presenting part may follow the curve of the pelvis, a movement similar to the flexion or extension of the head under the same circumstances must occur. This movement consists in a strong latero-flexion of the body, by means of which the anterior buttock passes beneath the symphysis, appears at the vulva, and is born. The posterior buttock in the meantime is distending the perinæum, and then the latero-flexion of the trunk continuing, it moves forward and in turn is born. If the perinæum is deficient owing to previous laceration, the posterior buttock may be born first, but, under normal circumstances, the sequence that we have described is found, save in the case of a small infant, when both buttocks may appear simultaneously. In the case of a complete pelvic presentation, the feet emerge alongside the buttocks.

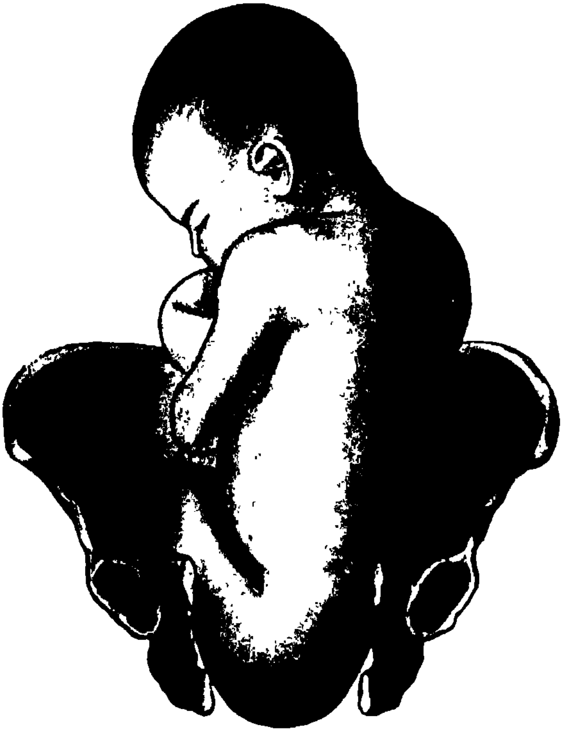

FIG. 243 - THE MECHANISM OF FIRST PELVIC PRESENTATION.
The breech has reached the pelvic floor, and internal rotation has occurred.

External Rotation.—As soon as the breech is free from the restraint imposed by the pelvic walls restitution occurs, and the bi-trochanteric diameter returns to its former position, only to again rotate back into the antero-posterior diameter of the outlet in association with the internal rotation of the shoulders. Both these movements are, however, less marked than they are in cephalic presentation.

Expulsion of the Trunk and Head.—If the further expulsion of the fœtus is left to the natural efforts, and if no traction is made

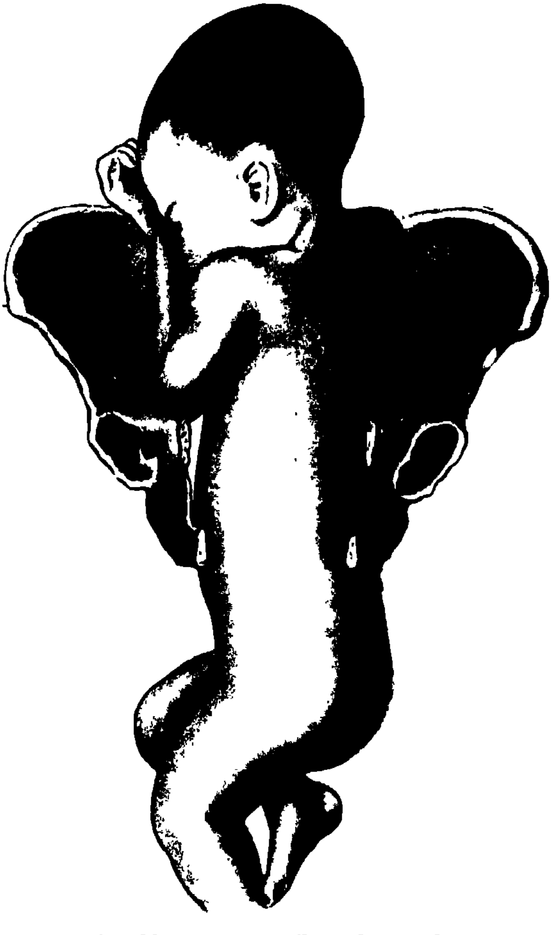

FIG. 244.—THE MECHANISM OF FIRST PELVIC PRESENTATION
The pelvic pole of the fœtus has been expelled, and the shoulders are descending in the left oblique diameter of the pelvis.

upon the part already born, the trunk is gradually expelled, the arms folded across the chest. The bis-acromial diameter of the shoulders passes through the brim in the same oblique diameter of the brim as did the bi-trochanteric (*v.* Fig. 244), and as the shoulders reach the outlet, it rotates into the antero-posterior diameter, the anterior shoulder turning forwards. The head passes through the pelvis in a position of flexion, which is maintained by the contractions of the uterus. Its antero-posterior diameters pass through the brim in the opposite oblique diameter to that traversed by the transverse diameters of the pelvis and shoulders. As the pelvic floor is reached, the occiput rotates in front, and the nape of the neck lies behind and below the symphysis. The head then rotating round the lower margin of the latter is born, with its antero-posterior diameters corresponding to the antero-posterior diameters of the outlet. The chin appears first, then the face, sinciput, and vertex, and lastly the occiput.

The delivery of the head is, however, not always a simple matter. As it descends into the pelvic cavity it passes out of the uterus, and, consequently, cannot be acted upon by the contractions of the latter. The motive power by which its expulsion is caused is thus seriously curtailed, and consists solely in the force supplied by the contractions of the voluntary muscles of labour. This force in some cases may be sufficient, but it cannot be relied upon, as the welfare of the child imperatively demands the rapid passage of the head through the pelvis. Consequently, we shall see, when discussing the management of pelvic presentation, that the delivery of the after-coming head from the vagina must be as systematically assisted as is the delivery of the placenta.

The foregoing general description of the mechanism of a pelvic presentation applies generally to all positions of the fœtus. We must now describe the mechanism of the different positions separately.

First Position, Back to the Left.—In the first position, with the back in front, the first position of Naegele, or the right sacro-anterior, the breech enters the pelvis with its bi-trochanteric diameter corresponding to the left oblique diameter of the pelvis. Descent occurs, and the breech remains in the same position until the pelvic floor is reached, the anterior hip lying slightly lower than the posterior hip. Internal rotation then occurs, and the anterior hip moves forwards from the anterior end of the left oblique diameter to lie beneath the symphysis. Latero-flexion of the trunk towards its left side occurs next, the buttocks appear at the vulva, and the breech is born, as has been described. Restitution brings back the bi-trochanteric diameter to its former position. The trunk then follows, the bis-acromial diameter of the shoulders rotating from the left oblique diameter into the antero-posterior diameter of the outlet, and producing a similar rotation of the breech externally. The head descends with its antero-posterior diameters corresponding to the right oblique diameters of the brim. As the pelvic floor is reached, the occiput rotates from the anterior end of the right oblique diameter to lie under the symphysis, and then the head, pivoting round this point, is born.

In the first position, with the back behind, fourth position of Naegele, or the left sacro-posterior, the breech enters the pelvis with its bi-trochanteric diameter corresponding to the right oblique diameter of the brim. Descent occurs, and as soon as the pelvic floor is reached, the anterior hip rotates forward from the anterior end of the right oblique diameter to lie beneath the symphysis. The breech is then born, with accompanying latero-flexion of the body towards its left side. Restitution frequently causes a rotation in a similar direction to that in which internal rotation occurred, instead of, as is usual, in the reverse direction. That is to say, the anterior hip turns from beneath the symphysis to lie at the anterior end of the left oblique diameter. This movement is probably the result of a movement of the fœtal trunk with the object of adapting its spinal curve to the spinal curve of the mother. As a result, the shoulders descend in the left oblique diameter of the brim, until the pelvic floor is reached, when the anterior shoulder rotates from the anterior end of the left oblique diameter to lie beneath the symphysis. The head descends with its antero-posterior diameters in the right oblique diameter of the pelvis, the occiput turned forwards, and from this position they rotate into the antero-posterior diameter as the pelvic floor is reached. The head is finally born as before. In some cases restitution occurs in the usual direction—that is to say, in the reverse direction to that in which internal rotation occurred—and the anterior hip rotates back again to the left side. In such cases the shoulders engage in the right oblique diameter, and the head with its antero-posterior diameters in the left oblique diameter, with the occiput turned backwards, or perhaps in the transverse with the occiput pointing towards the left side. In consequence, the head has to rotate through three-eighths or through one-half of a circle to bring the occiput behind the symphysis.

Second Position, Back to the Right.—In the second position, with the back in front, second position of Naegele, right sacro-anterior, the breech enters the pelvis with its bi-trochanteric diameter corresponding to the right oblique diameter. Descent occurs, and as soon as the pelvic floor is reached the anterior hip rotates from the anterior end of the right oblique diameter of the pelvis to lie beneath the symphysis. The breech is then expelled with an accompanying latero-flexion of the body towards its right side. A slight degree of restitution occurs, and brings the anterior hip back to its former position. The trunk follows, the bis-acromial diameter passing through the brim in the right oblique diameter, and then rotating into the antero-posterior diameter as the pelvic floor is reached. The head descends with its antero-posterior diameter in the left oblique diameter of the brim, the occiput directed forwards. As the pelvic floor is reached, the occiput rotates from the anterior end of the left oblique diameter to lie beneath the symphysis, and the head, pivoting round it, is born.

In the second position, with the back posterior, third position of Naegele, right sacro-posterior, the bi-trochanteric diameter passes through the brim in the left oblique diameter of the brim. Descent occurs, and, as the pelvic floor is reached, the anterior hip rotates forwards from the anterior end of the left oblique diameter to lie beneath the symphysis. The breech is then born with an accompanying latero-flexion of the body towards its right side. As in the first position with the back posterior, restitution not uncommonly causes a rotation in the same direction as that in which internal rotation occurred—that is to say, the anterior hip rotates towards the mother's left side. The shoulders, consequently, pass through the brim in the right oblique diameter of the brim, and the anterior shoulder rotates from the anterior end of the right oblique diameter to lie beneath the symphysis. The head then descends, with its antero-posterior diameters lying in the left oblique diameter of the brim, and the occiput rotates from the anterior end of this diameter through one-eighth of a circle to lie beneath the symphysis. Finally, the head, pivoting round this point, is born as before. In some cases, restitution may occur in the usual direction—that is to say, in the reverse direction to that in which internal rotation occurred, and consequently, the anterior hip rotates back to its original position. As a result, the shoulders engage in the left oblique diameter, and the antero-posterior diameters of the head in the right oblique, the occiput directed backwards. Consequently, the occiput has to rotate from the posterior end of this diameter through three-eighths of a circle to lie beneath the symphysis.

Abnormalities of Mechanism in Pelvic Presentation.—The occurrence of a foot and a knee presentation must strictly be regarded as an abnormality in the mechanism of a pelvic presentation, but as such an occurrence affects the ordinary mechanism to a very slight extent, it is unnecessary to discuss it separately. The only abnormality of any importance consists in a reversed rotation of the head.

Reversed Rotation of the Head.—In certain cases—most probably in those in which the back of the fœtus was directed posteriorly—the occiput, instead of rotating anteriorly and lying beneath the symphysis, rotates posteriorly into the hollow of the sacrum. In such cases, the face sometimes lies behind the symphysis, and at other times the chin hitches above the symphysis, and the face looks upwards. The expulsion of the head will in all probability never take place if left to the natural efforts. As we shall presently see, when the face lies behind the pubis delivery can be best obtained by first drawing the face downwards, the occiput being the last part born. When, on the other hand, the chin has caught above the symphysis, we must endeavour to cause the head to descend in the reverse manner, the occiput first passing over the perinæum, then the vertex and face, and lastly the chin.

Moulding.—The moulding of the after-coming head in a pelvic presentation is not carried to any marked extent, owing to the short period during which it is exposed to the pressure of the pelvic walls. Any moulding which does take place results in the diminution of the fronto-occipital and mento-occipital diameters, and in a compensatory increase in the cervico-bregmatic and sub-occipito-bregmatic diameters (*v.* Fig. 245).

The caput succedaneum forms over the anterior buttock and the genitals, and particularly affects the scrotum in male infants. In some cases, this part may become quite black from subcutaneous ecchymoses. It will, however, soon regain its normal condition.

Management.—The first point to be decided regarding the management of a pelvic presentation is the advisability or otherwise of allowing the pelvic presentation to persist. As we shall presently see, when discussing the maternal and fœtal prognosis, a pelvic presentation is always a source of danger to the fœtus, although, so far as the mother is concerned, it is no more dangerous than a vertex presentation. Accordingly, it is only for the sake of the fœtus that we need consider the necessity of changing the presentation. At first sight it appears to be obvious that, for the sake of the fœtus, we should always change a pelvic into a vertex presentation; but a little consideration will show us that it is not correct to compare the fœtal mortality which occurs in vertex presentation, when presumably all the conditions of labour are normal, with the mortality that occurs in pelvic presentation, when presumably there is some abnormal factor present which has been the direct cause of the pelvic

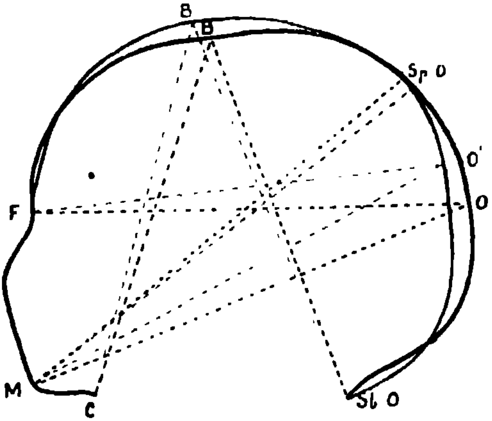

Fig. 245.—The Moulding of the Head in Pelvic Presentation

The black outline represents the unmoulded, the red the moulded head. (Budin.)

presentation. It is quite correct to assume that, if we meet with a pelvic presentation under conditions which are normal in every way save as regards the presentation, we shall reduce the fœtal mortality by correcting the presentation, but we cannot make this assumption in the greater proportion of cases of pelvic presentation. Contraction of the pelvis, for instance, is a common cause of pelvic presentation, and in certain forms and degrees of contraction the fœtal mortality will be less if the presentation is pelvic than if it is a vertex. Placenta prævia is another cause, and, in such cases, if the vertex presents, it is frequently necessary to bring about a pelvic presentation. Accordingly, we may definitely state that, in certain cases, the fœtal prognosis will not be improved by changing a pelvic into a vertex presentation. Further, it is often impossible to correct the presentation, either because we do not see the patient, or do not diagnose the presentation, until too late. Lastly, there are some cases in which the difficulty of correcting the presentation, even though the presenting part is not fixed, may be so great as to render it either impossible or inadvisable to try to do so. It will thus be readily seen that the proportion of cases in which it is both advisable and possible to change a pelvic into a vertex presentation is not great. As a general rule, it may be stated that version in these cases should only be performed by external manipulation, as the operation of internal or combined version is too serious a matter to be adopted as a routine practice. External version, however, necessitates the presence of certain conditions which we shall presently learn notably, a lax abdominal wall—and this condition is rarely found in primiparæ, in whom it is especially desirable to correct a pelvic presentation.

We may sum up the question of the advisability of the alteration of a pelvic into a vertex presentation in a few words. If there are no conditions present in which a pelvic presentation is preferable, and if it is possible to correct the presentation by external version, it is advisable to so correct it. If it is decided to perform version in any case, the most suitable time is shortly after the patient has come into labour. It is of little use to correct a pelvic presentation during pregnancy, as it will almost certainly recur, and if left until late in labour correction by external version is difficult or impossible. When the head has been brought over the brim, it must be held there until it fixes, or, if the uterine orifice is well dilated, the membranes may be ruptured, and the head then maintained in position by means of an abdominal binder tightly applied.

When a pelvic presentation is allowed to persist, the obstetrician must prepare for a labour in which his skill and knowledge may be tested to a very considerable extent. Perhaps in no other presentation does so much depend on the possession of these acquirements. In a vertex presentation the fœtus will in the great majority of cases be born without assistance. In a face presentation the amount of assistance which can be given is slight. In a pelvic presentation, assistance is both required, and, if given in the proper manner, of the greatest value.

There is a tendency in pelvic presentation, as in all other abnormal presentations, to the occurrence of premature rupture of the membranes, consequent on the fact that the pelvic pole does not fill the lower uterine segment as completely as does the cephalic pole. Moreover, in pelvic presentation it is especially necessary to preserve the membranes intact until the dilatation of the uterine orifice is as complete as possible. If the membranes rupture, the dilatation of the orifice is to a large extent dependent on the pressure of the breech, and is not as complete as it ought to be. Consequently, the incompletely dilated os may cause delay during the expulsion of the shoulders and head, and so increase the danger of fœtal asphyxia. To avoid premature rupture, the patient should be kept in bed from as early a period as possible in the first stage, especially in cases in which the membranes protrude unduly into the vagina during a contraction. The only other special precaution, which need be taken at this time, consists in making a vaginal examination towards the end of the first stage, and again as soon as the membranes rupture, to ascertain that the cord is neither presenting nor prolapsed.

As soon as the breech appears at the vulva, the patient should be placed in the cross-bed position, with her buttocks projecting slightly over the edge of the bed. The necessity for this precaution will be obvious when we come to discuss the delivery of the after-coming head. Before describing the assistance which must be given, we must call attention to two important principles. The first of these is the necessity for maintaining throughout delivery the normal mechanism which has been already described. If the process of expulsion has to be hastened at any time, this must be done in a manner that will not interfere with this mechanism, as otherwise, instead of hastening expulsion, we shall retard it, or perhaps render it impossible. The second principle is to refrain as long as possible from all traction upon the body of the fœtus. If the natural efforts must be supplemented, in all cases this should first be done by pressure upon the fundus. This principle is really only an amplification of the former one. It is impossible to maintain the normal mechanism if traction is made upon the body; but, if pressure is applied from above, the effect is the same as if the contractions of the uterus were increased in strength, and, consequently, there is no interference with the normal mechanism. Traction on the body obstructs the normal rotations, and so tends to cause impaction in the pelvic cavity. Further, it almost invariably leads to extension of the arms of the fœtus. When the latter is expelled by the uterine contractions, its arms are kept in contact with the chest by the pressure of the uterine walls, until such time as the chest has passed into the pelvis, when the pressure of the pelvic walls serves the same purpose. When the fœtus is dragged down by traction on the legs or body, the controlling pressure of the uterine walls is lost, and the arms are no longer pressed against the chest; consequently, the projecting elbows are caught by the pelvic brim. Then, instead of passing through the pelvis at the same time as the chest, they are pushed upwards beside the head, and if left in this position will obstruct or altogether prevent the passage of the latter through the pelvis. In some cases, however, it is not always possible to obey this principle, as pressure upon the fundus may not supply the necessary amount of force to expel the fœtus; then traction must be made, and we must be prepared for its bad consequences and ready to correct them.

It is unnecessary to take the same precautions for the protection of the perinæum in a pelvic presentation as in a vertex, as the fore-coming breech rarely or never distends the perinæum sufficiently to cause a laceration. On the other hand, the after-coming head may cause considerable laceration, especially in primiparæ, as it must be delivered so rapidly that sufficient time is not given for dilatation to occur. As the breech appears at the vulva, the fingers should be slipped into the vagina beside it in order to discover the position of the feet. If the latter are lying beside the breech, each foot is in turn guided out in order to prevent them from catching above the perinæum, as in this manner a laceration may be caused. The breech and lower limbs are then expelled in the case of a complete presentation, or the breech alone in an incomplete presentation, without any further assistance. As soon as the umbilicus of the infant reaches the vulva, it is necessary to draw gently down a loop of the cord. The object of this procedure is twofold. In the first place, it is very important to have a reliable guide to the condition of the fœtus, inasmuch as we do not wish to interfere with the natural mechanism of expulsion, unless the condition of the fœtus is such that delivery must be accelerated. When we have drawn down a loop of the cord, observation of the nature of its pulsations informs us if the fœtus is commencing to suffer. In the next place, if the cord is not drawn down, there is a danger of its tearing, owing to the stretching which it may undergo. The body of the fœtus compresses the cord between itself and the brim of the pelvis, and tends to hold it there; consequently, as the body descends and increases the distance between the umbilicus and the pelvic brim, there is no accompanying increase in the length of the cord between the umbilicus and the spot at which it is compressed, the cord becomes progressively tighter, and may finally tear away at the umbilicus owing to the traction exerted upon it.

Having drawn down a loop of the cord, no further interference is necessary so long as its pulsations continue, and all that need be done is to support the body of the fœtus in its proper relation to the pelvis. The ensuing uterine contractions in a normal case expel the remainder of the fœtal trunk and the arms folded across the chest, and then drive the head through the brim into the pelvic cavity. From the latter, however, it will almost certainly require to be delivered by artificial means.

If, however, the cord is found to be pulseless when brought down, or if it ceases to pulsate prior to the expulsion of the shoulders, the delivery of the latter must be hastened. This is the stage of delivery at which it is so important to remember the distinction between the effects of pressure applied over the uterus and of traction upon the body. Pressure acting as a *vis a tergo* resembles the uterine contractions and keeps the arms in contact with the chest. Traction acting as a *vis a fronte* tends to cause the arms to be pushed away from the chest by the pelvic brim and so to become extended. Accordingly, if it is necessary to hasten delivery, the first method to adopt is firm pressure over the fundus of the uterus. By this means, in many cases, the chest will be driven out with the arms in their proper position; or, even if this does not occur, it will be driven into the pelvic cavity without extension of the arms, and then, if traction has to be made, the results are not so serious as if the arms were still above the brim. If, however, pressure from above is not sufficient to cause the expulsion of the fœtus, we are compelled to resort to traction upon the body. The latter is seized in both hands by the pelvis and drawn downwards as far as possible. If the body is slippery, as is frequently the case, it is well to first wrap round it a clean napkin or towel. In all cases, while the body is being drawn downwards, the nurse or other assistant should at the same time make pressure upon the fundus with both hands so placed that they encircle, not only the fundus of the uterus, but also the sides, as the pressure thus exerted may be successful in preventing the arms from being pushed away from the body. When the body has been drawn downwards as far as possible, the fingers are passed into the vagina to ascertain if the arms have also descended. If they have done so they will be found in the vagina, and can easily be drawn out by hooking a finger into the bend of the elbow and pulling the latter down. If, on the other hand, they are not found in this position, they have become extended, and must be brought down before any attempts are made to deliver the head. The method of doing this will be described later in the chapter on the extraction of the fœtus in pelvic presentation.

The final step in the delivery of the fœtus is the extraction of the after-coming head. We have already pointed out the frequent necessity for artificial aid at this stage, as the head, having passed beyond the uterus, is not affected by the contractions of the latter. It is safe to say that, if the head is not expelled by the same contraction that expels the shoulders, it must be extracted by the obstetrician.

The most critical period of delivery, so far as the child is concerned, is reached when the head has been expelled from the uterus and is lying in the pelvic cavity. The latter is so completely filled by the head that the cord is almost certainly compressed and circulation through it checked. The empty uterus is commencing to detach the placenta, so that even if the cord is not compressed the danger of asphyxia is considerable. The cold air chilling the body of the fœtus causes premature attempts at inspiration, and consequent inhalation of mucus and fluid into the larynx. Consequently, it is of the greatest importance that the head should be extracted from this position as rapidly as possible.

The various methods of effecting the delivery of the head will be discussed in the chapter on the extraction of the fœtus in pelvic presentation.

Prognosis.—The maternal prognosis in uncomplicated cases of pelvic presentation is very similar to that in vertex presentation. Perhaps, in primiparæ, the liability to extensive laceration during the delivery of the after-coming head is greater than when the head comes first. In cases of pelvic presentation, complicated with some other pathological condition, such as contracted pelvis, the prognosis is dependent on the nature of the complication.

The fœtal prognosis, on the other hand, is by no means as favourable as in vertex presentation, on account of the danger of asphyxia during the passage of the after-coming head. It is extremely difficult to estimate the average mortality in these cases, as it will differ to a marked degree according to the skill and experience of the obstetrician. Hecker estimates the mortality at 26 per cent.; Herman* as at least 1 in 10, and sometimes as much as 1 in 3; Galabin† as 1 in 3 in the case of an extern maternity attended by students, and where in many cases delivery had occurred before the student arrived. At the Clinic Baudelocque,‡ on the other hand, out of 91 children whose mothers were primiparæ 82 lived, and out of 61 children whose mothers were multiparæ 53 lived; or, in all, a mortality of about 1 in 10. In all these cases, the children were alive at the commencement of labour. At the Rotunda Hospital, amongst 435 viable infants born as pelvic presentations, 118 were born dead, or a mortality of 1 in 3·6. It must, however, be remembered that the high rate of mortality in pelvic presentation is in part due to the fact that in many cases the presentation is the direct result of the antecedent death of the fœtus. Thus, amongst the 118 children who were born dead at the Rotunda Hospital, 51 were macerated.

Injuries to the child during birth are also of relatively common occurrence. In cases of impacted or obstructed breech, as we shall see in another place, fracture of the femur may occur; and, if a fillet or blunt hook has been used to effect delivery, extensive laceration of the soft parts in the neighbourhood of the groin may result. Then, during the delivery of the arms fracture of the humerus or clavicle may occur. The humerus is, as a rule, broken by the direct pressure of the fingers. The clavicle is probably broken by inward pressure acting through the head of the humerus, and tending to approximate the ends of the bone. Such a force may result either from the hand being pushed upwards between the side of the child and the pelvic wall, or from the pressure of the pelvis directly on the head of the humerus during the rotation of the latter while the arm is being brought down.

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* *Op. cit.*, p. 36. † *Op. cit.*, p 251

‡ Ribemont Dessaignes and Lepage, *op. cit.*, p. 468.

Injuries to the spinal column or to the soft parts may result from too violent traction upon the trunk, and the ligaments of the joint between the atlas and the axis vertebræ may be torn by forcible rotation of the body when the head is fixed.

Lastly, violent extraction of the head may lead to most severe injuries. It is quite possible to rupture the articulations of the cervical vertebræ and to tear the spinal cord. The clavicles may be broken by the pressure of the fingers when applying traction on the shoulders, and the brachial plexus may at the same time be injured by pressure, with the result that temporary paralysis may be caused (Herman). A relatively common occurrence is the rupture of a small bloodvessel in the sterno-mastoid muscle, leading to the formation of a hæmatoma, varying in size from that of a marble to that of a pigeon's egg, or a little larger. Traction applied on the floor of the mouth may result in laceration of the mucous membrane or tongue, or in dislocation or fracture of the jaw.

CHAPTER VII

TRANSVERSE AND OBLIQUE LIES

Frequency—Ætiology—Positions—Diagnosis—Mechanism—Terminations, Spontaneous Version, Spontaneous Evolution, *Corpore Conduplicato*—Treatment, Postural, Cephalic Version, Podalic Version—Prognosis.

So far, we have been alone concerned with the various presentations which are met with in longitudinal lies of the fœtus, and now we must deal with cases of transverse or oblique lies. It is, of course, obvious that strictly these cases should not be considered under the physiology of labour, but inasmuch as it is

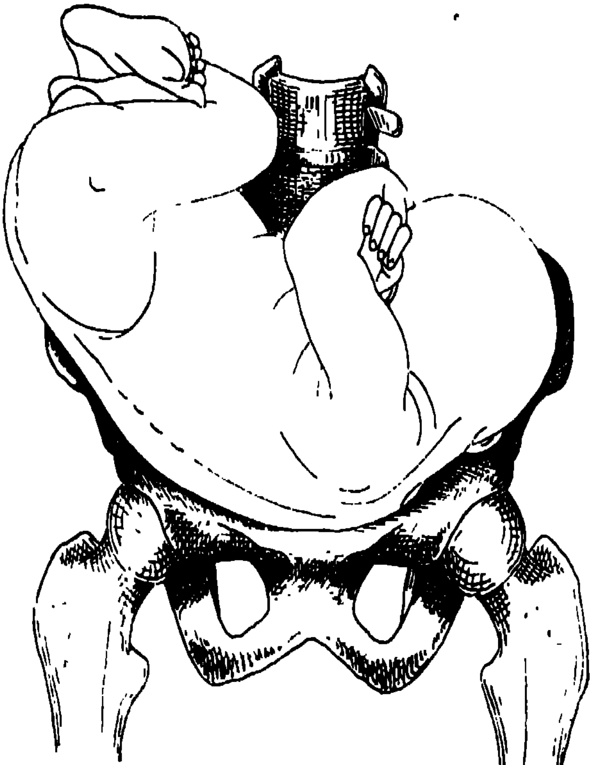

FIG. 246.—FIRST SHOULDER PRESENTATION, BACK IN FRONT. (Farabœuf.)

advantageous to deal with all the different presentations consecutively, we shall do so.

As has been already mentioned, the actual presentation which occurs in a transverse or oblique lie is not a matter of very great importance, since it is overshadowed by the greater importance of the fact that, no matter what part of the fœtus presents, the latter cannot be delivered under otherwise normal circumstances. Consequently, we need not consider each possible presentation separately, but may group them all under the comprehensive term of 'shoulder presentation.' Accordingly, under this term we include all cases in which neither the cephalic nor the podalic pole of the fœtus presents, and in which the long axis of the fœtus lies transversely or obliquely in the uterus. In the large majority of cases one or other shoulder presents at the commencement of labour, and as labour advances the corresponding arm is driven down into the pelvis. Occasionally, however, at the commencement of labour, the actual presentation may be part of the thorax, the elbow or hand, a hand or hands, and a foot or feet, or any part of the back. But as labour advances, in almost every case, if the lie of the fœtus is not corrected, the presentation finally becomes a shoulder presentation, in which the corresponding arm has been driven down into the vagina. The term 'cross-birth' is also frequently used as a synonym for all cases of oblique or transverse lies.

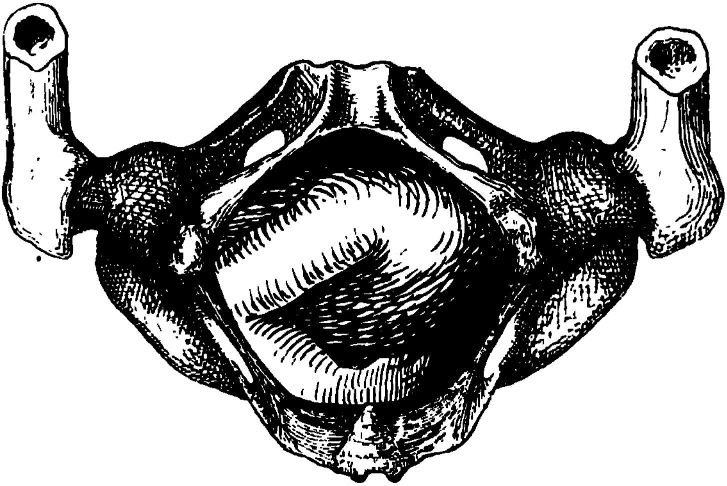

FIG. 247.—FIRST SHOULDER PRESENTATION, WITH THE BACK IN FRONT

The shoulder presenting at the brim, as felt by vaginal examination

Frequency.—The relative frequency with which transverse or oblique lie occurs in different countries differs very markedly.

In Germany, where its proportion is highest, transverse lie was met with 2,195 times amongst 302,075 deliveries, or a proportion of 1 in 137 (Winckel). In France, it occurred 192 times in 40,036 cases, or a proportion of 1 in 208½, according to various statistics collected by Churchill,* while, according to Pinard, it occurs in a proportion of 1 in 125 cases. In British practice, according to various statistics, also collected by Churchill, it occurred 517 times in 125,670 cases, or a proportion of about 1 in 243. In Guy's Hospital, it occurred amongst 49,588 cases in a proportion of 1 in

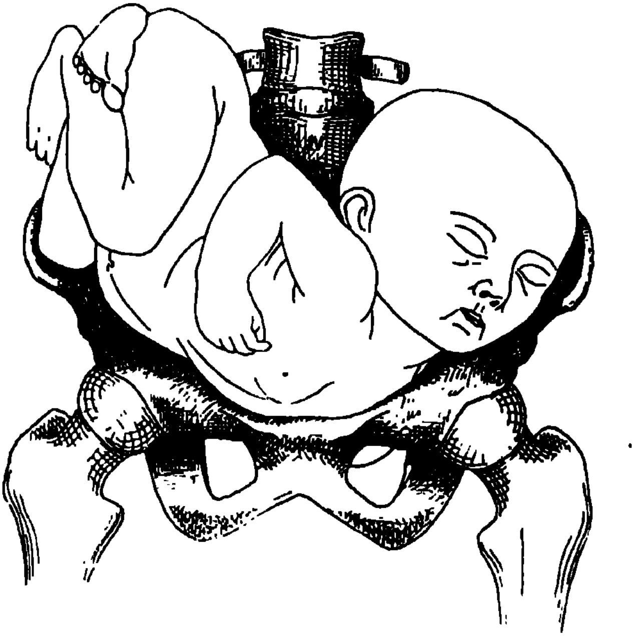

FIG. 248.—FIRST SHOULDER PRESENTATION, THE BACK BEHIND. (Farabœuf.)

354 (Galabin). Finally, at the Rotunda Hospital, during the last fourteen years it occurred 53 times in 19,293 cases, or a proportion of 1 in 364·01. As the occurrence of a transverse lie cannot easily be overlooked, and as all these statistics are based on the experience of well-known authorities, there must be a definite cause for the marked differences in frequency which are found. The most obvious explanation which offers itself is that on the Continent the proportion of cases of contracted pelvis is very much greater than in these countries, and as this condition favours the occurrence of a transverse lie of the fœtus, it is not

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* 'Theory and Practice of Midwifery,' fifth edition, p. 471.

surprising to find a higher proportion of cases abroad than at home.

Causes.—We have seen that the common cause of malpresentation is loss or alteration of the normal relation which exists between the shape of the fœtus and the shape of the uterine cavity. So long as this loss or alteration is not too great, a longitudinal lie of the fœtus will still occur, although the pelvic pole may occupy the lower uterine segment instead of the fundus. If, however, the alteration is so marked that the uterine wall no longer exercises a restraining effect on the lie of the fœtus, then transverse or oblique lies become relatively common. Accordingly, in enumerating the various conditions which favour the occurrence of this lie, we must expect to obtain a list very similar to that given in the case of pelvic presentation, inasmuch as it is to a difference in the degree of the condition present, rather than in the actual condition itself, that the occurrence of a pelvic presentation in one case and of a shoulder presentation in another case is due. The principal causes of transverse or oblique presentation are as follows:—

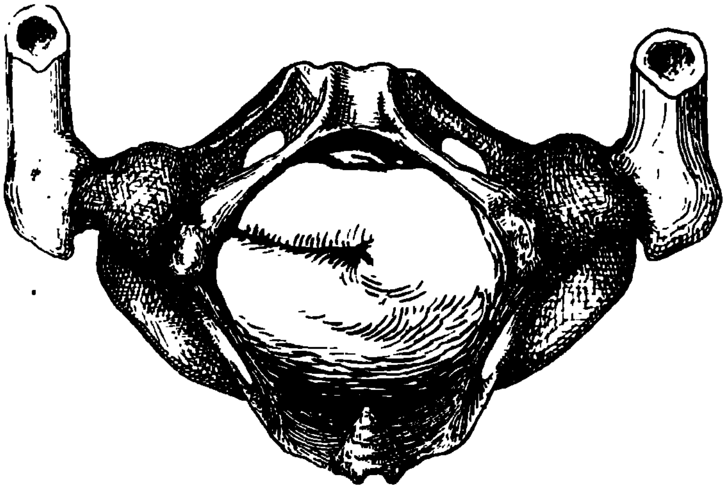

FIG. 249.—FIRST SHOULDER PRESENTATION, WITH THE BACK BEHIND.
The shoulder presenting at the brim, as felt by vaginal examination.

Contracted Pelvis.—Michaelis[*] met with shoulder presentation in 1·2 per cent. of patients in whom the pelvis was normal, while in patients in whom the pelvis was contracted he found the same presentation in 5·4 per cent. of cases.

Tumours of the Uterus.—In 195 cases of myomata of the uterus, shoulder presentation occurred twenty-two times—*i.e.*, in about 11·3 per cent.*

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[*] 'Das enge Becken,' p 183.

3 Multiparity.—The greater the number of children a woman has borne, the more lax becomes the uterine wall, and the less the controlling pressure exerted upon the fœtus. According to Winckel,† shoulder presentation occurs four times more frequently in multiparæ than in primiparæ, and eight times more frequently in pluriparæ than in multiparæ.

4 Multiple Pregnancy.—An oblique presentation is said to occur in cases of twins in a proportion of 1 in 15·7, and to be more common in the case of the second twin (Winckel). This is but natural, as the controlling effect of the pressure of the uterine wall on the second twin is very slight.

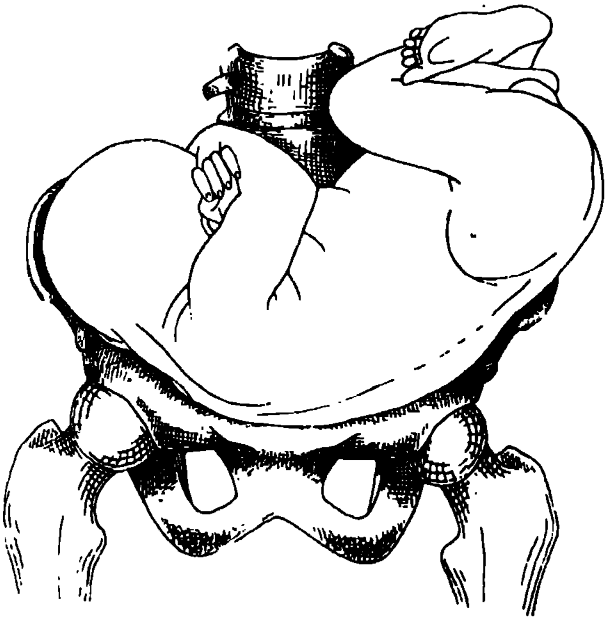

FIG. 250.—SECOND SHOULDER PRESENTATION, THE BACK IN FRONT. (Farabœuf.)

5 Hydramnios.—This condition has been found in 10 per cent. of cases of shoulder presentation (Winckel), whereas the usual proportion of cases in which it occurs is about 1 in 200.

6 Premature Children.—According to Simpson,‡ oblique pre-

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* Süsserot, I. D., Rostock, p. 8, 21, fig. 48; and Toloczinow, *Wiener med. Presse*, 1868, Nr. 30.

† *Op. cit.*, p. 402.

‡ 'Obstetric Memoirs,' edited by Priestley, vol. ii., 1856, p. 138.

sentations are met with in the case of premature children ten times more frequently than in the case of full-term children.

Macerated Fœtus.—According to various statistics collected by Winckel, the fœtus is macerated in 12·2 per cent. of cases of shoulder presentation.

Malformations of the Uterus.—Cases have been recorded in which repeated shoulder presentation has occurred in association with such malformations of the uterus as uterus bicornis and uterus septus, so clearly proving a causal relationship.

Malformations of the Fœtus.—Monstrosities, tumours, cystic conditions of the fœtal organs, collections of fluid in the thorax or peritoneal cavity, all favour the occurrence of shoulder presentation in accordance with their site and the effect they produce on the shape of the fœtus.

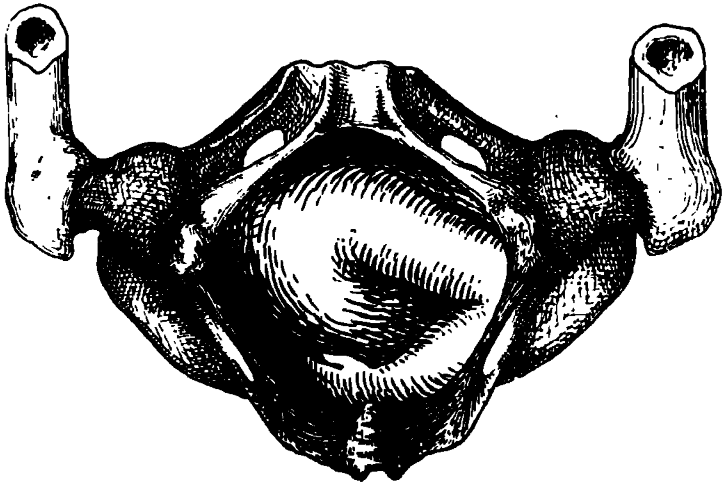

FIG. 251.—SECOND SHOULDER PRESENTATION, WITH THE BACK IN FRONT. The shoulder presenting at the brim, as felt by vaginal examination.

Obliquity of the Uterus.—This condition, especially when in association with a large and lax uterus, is prone to cause oblique lies of the fœtus.

Placenta Prævia.—Simpson found 15 cases of placenta prævia amongst 366 cases of shoulder presentation—a proportion of about 1 in 24. The ordinary proportion of cases in which placenta prævia occurs is 1 in 200 to 300.

The foregoing are the more common causes of transverse or oblique lie of the fœtus. There are also rarer causes. Extreme shortness of the umbilical cord has been noticed in a few cases, as have ovarian tumours and prolapse of a hand alongside the head.

15 A curious and so far unexplained fact is to be found in the very much larger proportion of male than female infants that are met in transverse or oblique lies. Thus, Winckel found amongst 282 cases of these lies 192 male and 90 female infants, whereas the usual proportion of male to female infants is as 17 is to 16.

Positions.—It is not possible in transverse or oblique lies of the fœtus to adopt a similar classification of positions to that adopted in longitudinal lies, as the relation of the back to the middle line is so very different. Several different classifications have been proposed from time to time, and of them perhaps the best, and the one most nearly in keeping with the system of classification which we have so far adopted, is that proposed by Hoffle,* who recognises two positions, according to the side of the mother to which the head of the fœtus is turned, and subdivides them into two more according as the back is directed in front or behind.

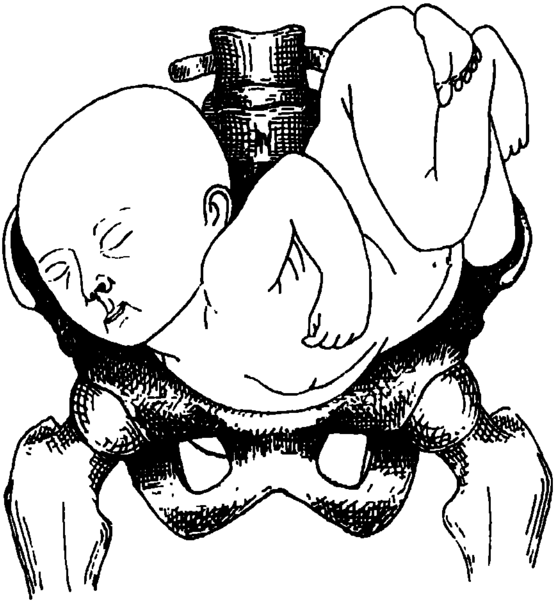

FIG. 252.—SECOND SHOULDER PRESENTATION, THE BACK BEHIND. (Farabœuf.)

Those who adopt Naegele's classification of positions in longitudinal lies may, however, consider the classification of Winckel more suitable in the present case, as the latter recognises four positions, and numbers them in order of frequency. The two classifications may be tabulated thus:—

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* *Lehrb.*, II. Aufl., 588.

First position, head to the left.	Back in front (first position of Winckel). Back behind (fourth position of Winckel).
Second position, head to the right.	Back in front (second position of Winckel) Back behind (third position of Winckel).

From the statistics of 894 cases of transverse or oblique lie collected by Winckel, it appears that the number of cases in which the back lies in front is to the number in which it lies behind as 1½ is to 1, while the head is almost equally frequently directed to the left or to the right.

Diagnosis.—The diagnosis of transverse or oblique lies can be made by abdominal palpation and vaginal examination, and perhaps occasionally by auscultation.

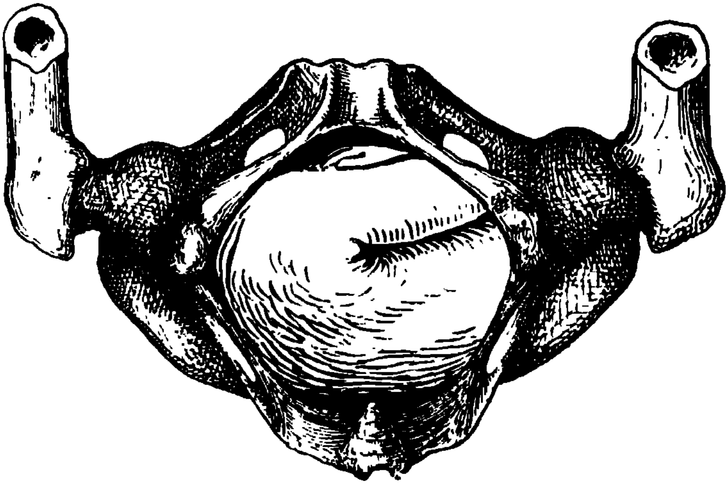

Fig. 253.—Second Shoulder Presentation, with the Back Behind.
The shoulder presenting at the brim, as felt by vaginal examination.

Abdominal Palpation.—If the lie is transverse, neither pole of the fœtus will be found at the fundus. If the lie is oblique, one or other pole may be found displaced into one or other hypochondrium. Then, on carrying the hand lower down, the opposite pole is found in the opposite iliac region. If the back is anterior, it is readily felt as a firm and resisting mass connecting the two poles. If it is posterior, the limbs are felt with considerable distinctness pressed against the abdominal wall. If labour has only recently commenced, the pelvic brim is found to be empty, and the outline of a shoulder may be made out lying near the brim. If labour has been in progress for some time, and the presenting part has been driven into the brim, it will be difficult to determine the exact nature of the part on account of the manner in which the fœtal trunk is compressed, but in most cases there will even then be no difficulty in detecting the presence of the head in the false pelvis.

Vaginal Examination.—At the commencement of labour, it is usually impossible to reach the presenting part, unless the entire hand is passed into the vagina. As, however, the presenting part is driven down into the brim, it can be readily reached and its nature determined. At first, it is most usual to find a shoulder presenting, or perhaps some part of the thorax. Later, an arm usually prolapses, and can be recognised and distinguished from a leg in the manner which has been already described. It is easy to determine to which side the arm belongs if we imagine ourselves shaking hands with it. If the thumb of the examining hand lies in contact with the thumb of the prolapsed hand, the palms being in imaginary contact, the prolapsed hand must be right or left, according as the examining hand is right or left. A careful examination must also be made in these cases to determine whether the umbilical cord is lying over or in the

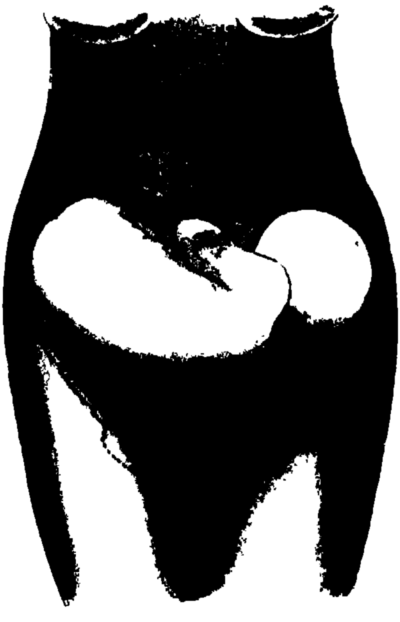

FIG. 251. DIAGRAM REPRESENTING THE FŒTUS AS FELT BY ABDOMINAL PALPATION IN SHOULDER PRESENTATION.

The shaded portions of the fœtus are those that are felt most distinctly.

uterine orifice, as prolapse or presentation of the cord is relatively very common.

Auscultation.—Auscultation as a means of diagnosis in shoulder presentation is not of any great value, as there is nothing very characteristic in the position in which the heart is heard. If the back lies in front and labour has not progressed far, the heart is heard in or close to the middle line and nearer to the symphysis than is usual at this stage of labour. If the shoulder has descended into the pelvis it may be impossible to hear the heart at all, even though the fœtus is alive. If the back is posterior, it may be also impossible to hear the heart on account of the depth below the surface at which it lies.

Mechanism.—There is no mechanism in the ordinary sense of the word in a shoulder presentation, for the obvious reason that, save in rare cases and under certain conditions, the expulsion of the fœtus is impossible. The course that labour pursues is that a shoulder is driven down into the pelvis and the corresponding arm prolapses. As labour continues, the shoulder is driven down still more deeply, until its further advance is checked by the size of the diameters which are brought into the brim. Then, if the case remains untreated, the fœtus dies, and if the uterine contractions continue the uterus ruptures. If the contractions cease, the fœtus commences to decompose and the mother dies of exhaustion and septic absorption. Although there is no mechanism in the case of transverse presentations, there are certain terminations which may occur and result in delivery, but though these terminations are the result of the natural efforts, they must in no way be considered to be natural terminations; on the contrary, they are quite unnatural and exceptional.

Terminations.—These terminations are as follows:—Spontaneous version; spontaneous evolution; and birth *corpore conduplicato.*

Spontaneous Version.—This is the term applied to the correction of the lie of the fœtus by the contractions of the uterus, and results in the presentation of either the cephalic or pelvic pole. It is especially likely to occur in oblique lies, and can in some cases be brought about by placing the patient in a suitable position, as will presently be described. Spontaneous version may occur either before or after rupture of the membranes. When the resultant presentation is pelvic, version usually takes place after the membranes have ruptured, when cephalic, before the membranes have ruptured. In cases in which a pelvic presentation results, a foot or knee presentation is the usual variety, owing to the fact that in an oblique lie of the fœtus with the pelvic pole lowest the feet may be found immediately over the internal os, and so may be the first part driven down after the membranes have ruptured. Several English writers, notably Herman and Galabin, limit the term 'spontaneous version' to cases in which a shoulder presentation is converted into a pelvic presentation, while they term its conversion into a cephalic presentation 'spontaneous rectification.' This appears to us to be a needless multiplication of terms, inasmuch as in ordinary obstetrical nomenclature the correction of the lie of the fœtus, or the substitution of one pole for the other, is termed 'version.' If we here adopt the term 'rectification' we should, in order to be consistent, also substitute it for the term 'cephalic version' in all other cases. The manner in which spontaneous version occurs prior to the rupture of the membranes is not difficult to understand. Before labour, the uncontracted uterus allowed the fœtus to lie in such a position that its long diameters did not correspond with the long diameters of the uterus, but, as soon as contractions occur, the pressure of the uterine wall tends to guide the fœtus round into a longitudinal lie. If the patient is placed in such a position that the action of gravity on the fœtus facilitates this change, the latter occurs prior to rupture of the membranes with comparative frequency in oblique lies. The manner in which a shoulder presentation sometimes becomes converted into a pelvic presentation after the rupture of the membranes is more difficult to explain. The process was first described by Denman* under the term 'spontaneous evolution,' but this term is incorrect and more properly applied to a quite different phenomenon. Denman's explanation of the manner in which the change of presentation occurs, put shortly, was that the body in its doubled state being too large to pass into the pelvis, the contractions of the uterus, acting principally upon the pelvic pole, which is the only part free to move, drive the latter downwards, while at the same time the cephalic pole is crowded upwards farther away from the brim. If this movement is continued, it is possible to imagine that at a certain stage the pelvic pole will come to lie a little lower than the cephalic pole, and that once this happens there will be a tendency for the latter to ascend to the fundus, leaving the former free to descend into the brim. It is, however, a most difficult process to explain, and occurs in so few cases that in practice it must not be taken into consideration.

Spontaneous Evolution.—This peculiar process was first described by Douglas† of Dublin. Its nature will be best understood by reference to the accompanying diagrams (*v.* Figs. 255, 256). The shoulder is driven down into the pelvis and the corresponding arm prolapses. The corresponding clavicle and the side of the neck is fixed behind the symphysis, and the back, acutely flexed, is driven downwards and appears at the vulva. The remainder of the trunk is then driven down, the angle of flexion of the spine moving gradually downwards along the spine towards the breech, until, finally, the breech and lower limbs are born. All this time the remaining arm and shoulder and the head are still above the brim, and the final act consists in their expulsion as in a pelvic presentation. It will thus be seen that the entire body revolves round the shoulder, which is jammed against the symphysis. It will readily be understood that this mechanism can only take place in a small and very soft fœtus, and its occurrence has rarely been noted save in one which was premature and macerated. Still, cases have been recorded in which the fœtus was not only born alive, but subsequently lived. Under any circumstances spontaneous evolution is a phenomenon of great rarity, and the possibility of its occurrence must never be taken into consideration in the management of a case.

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* 'Introduction to the Practice of Midwifery,' seventh edition, p. 355.

† 'Explanation of the Real Process of the Spontaneous Evolution,' etc., second edition. Dublin, 1819.

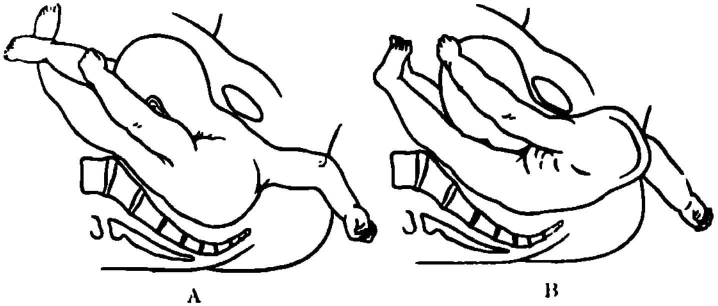

FIG 255.—SPONTANEOUS EVOLUTION OF THE FŒTUS IN SHOULDER PRESENTATION.

A, First step; B, second step.

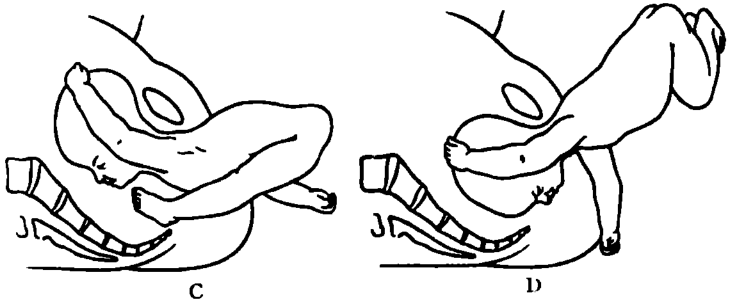

FIG. 256.—SPONTANEOUS EVOLUTION OF THE FŒTUS IN SHOULDER PRESENTATION.

C, Third step, D, fourth step.

Birth 'Corpore Conduplicato.'—Birth *corpore conduplicato*, or spontaneous expulsion, as it is sometimes termed, was first described by Kleinwächter.* The first stage in this process is similar to that of spontaneous evolution. The shoulder is driven down into the pelvis, the arm prolapses, and the back, acutely flexed, appears at the vulva. Then, the head, the second arm, and the breech closely compressed descend together through the pelvis and are born, the lower limbs being the last to appear. Such a process necessitates a smaller and softer fœtus than even spontaneous evolution, and it never occurs save in a dead and macerated fœtus.

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* *Arch. f. Gyn.*, B. II, p. 111

Management.—In all cases in which it is possible a transverse or oblique lie of the fœtus must be changed into a longitudinal lie, and if it is impossible to do so, embryotomy must be performed. There are three principal methods by which the lie of the fœtus can be corrected, and the method of choice is always that by which the correction can be effected with the least possible amount of manipulation and by external manipulation rather than internal. The three methods of correction are as follows:—Postural treatment; cephalic version; and podalic version.

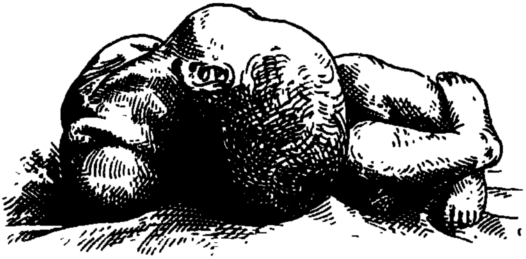

FIG. 257.—THE MOULDING OF THE FŒTUS THAT OCCURS DURING BIRTH 'CORPORE CONDUPLICATO.'
(From a photograph of a case at the Rotunda Hospital.)

Postural Treatment.—Postural treatment consists in placing the patient in such a position that the action of gravity brings the fœtus into a longitudinal lie. As has been already said, it is merely a means of increasing the tendency to the occurrence of spontaneous version. In order that it may be successful the membranes must be intact, so that the fœtus is free to move in the uterine cavity, and the presenting part must be above the brim. When the patient lies upon one side, the fundus of the uterus falls over to that side, carrying with it one pole of the fœtus and tending to cause a corresponding deviation of the other pole towards the opposite side (*v.* Fig. 258). Accordingly, in carrying out the postural treatment, the patient lies, during the first stage, upon the side at which is found the lower pole of the fœtus. In a favourable case this pole is as a result carried over the pelvic brim, where it will be felt by abdominal palpation. If this occurs, nothing further need be done until the uterine orifice is

PART V

THE PHYSIOLOGY OF THE PUERPERIUM

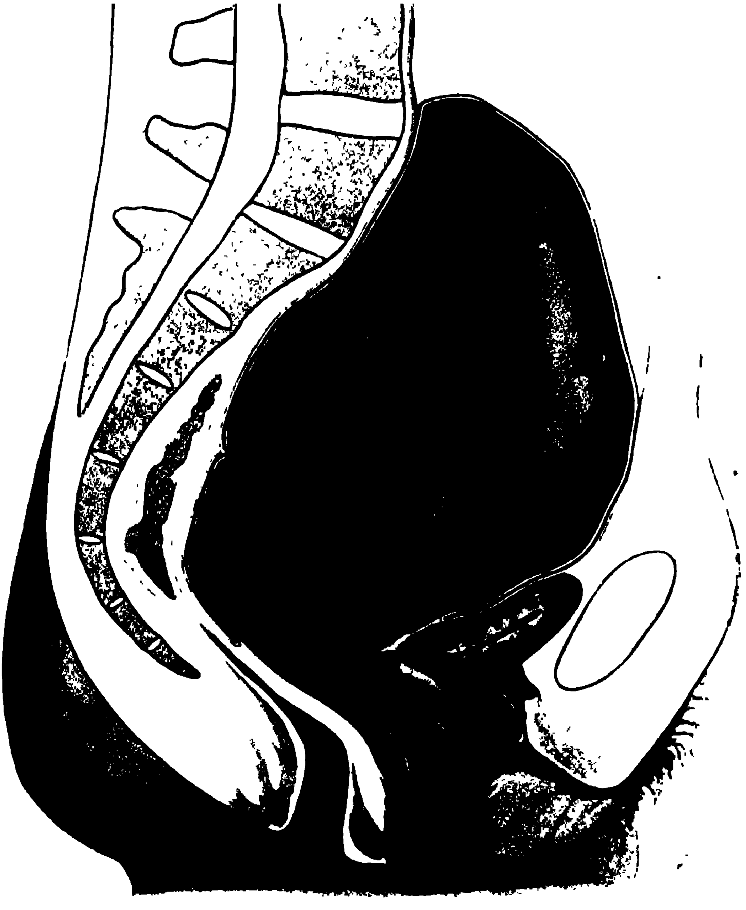

PLATE V.—MESIAL SAGITTAL SECTION OF A WOMAN WHO DIED FIVE MINUTES AFTER DELIVERY. (Webster)

[*To face p.* 441

CHAPTER I

THE PHENOMENA OF THE PUERPERIUM

Changes in the Genital Tract: Changes in the Uterus, in the Appendages and Ligaments, in the Vagina, in the Perinæum and Pelvic Floor—Changes in the Breasts—The Composition of Milk—Changes in the Organism in General, in the Circulatory System, in the Temperature, in the Urinary System, in the Digestive System, in the Respiratory System and Skin, in the Abdominal Walls, in the Pelvic Joints Symptoms—Diagnosis.

THE puerperium, or the puerperal state, is the term applied to the period during which the woman is recovering from the effects of pregnancy and parturition. Strictly speaking, it lasts from the completion of the third stage until the completion of uterine involution—that is, for about six weeks, but, clinically, it is considered to end as soon as the lochial discharge has ceased—that is to say, about the tenth or twelfth day. During this period the maternal organism is recovering from the changes which occurred in it as a result of pregnancy and labour, and the future welfare of the woman demands that this process of repair should be carried out in a normal manner and should be complete. Accordingly, it is necessary to carefully study the phenomena of the normal puerperium.

The phenomena of the puerperium may be divided into three groups.—

(1) Changes in the genital tract.
(2) Changes in the breasts.
(3) Changes in the organism in general.

CHANGES IN THE GENITAL TRACT.

As the changes which occur in the genital tract are of necessity very considerable, they will be considered under different heads.

Changes in the Uterus.—The changes which occur in the uterus are included in the term 'involution of the uterus.' Immediately after the completion of labour the uterus may be considered as consisting of two parts, the upper uterine segment and the lower uterine segment and cervix. The upper segment includes all that lies above the retraction ring, and is firm and more or less globular in outline. The lower segment and cervix include all that lies below the retraction ring, and is soft, flabby, and shapeless. The cervical portion is thicker than the lower uterine segment, but it it impossible to exactly determine their junction. The fundus of the uterus reaches to the umbilicus, or perhaps a little higher, and the walls of the upper segment are about one and a half inches in thickness. On examining the inner surface, two areas, differing considerably in appearance, can be distinguished. The first of these is the placental site, and the second the remainder of the uterine cavity. The placental site is oval in form, measures about four inches by three inches, and is represented by a slightly raised surface of irregular elevations and depressions, due to the adherent remains of the spongy portion of the decidua serotina. It is usually covered by clots, which pass into the mouths of the vessels, and if the clots are gently removed the latter become visible. The remainder of the uterine cavity is smooth, save where small elevations formed by fragments of decidua project. The junction between the upper and lower segments is easily distinguished, owing to the sudden change from the thick and firm walls of the former to the thin and flaccid walls of the latter. The lower segment and cervix are congested and œdematous owing to their relaxed condition, and so contrast with the somewhat anæmic condition of the remainder of the uterus. Their surface is similar to that of the upper segment, save that no decidua is found in the cervix. The junction between the two—*i.e.*, the internal os—can scarcely be detected, so completely has the cervical cavity become incorporated with the lower uterine segment. At the end of about six weeks, when involution is ended, the uterus has returned almost completely to its non-impregnated condition, and only differs from a virginal uterus in that it is slightly larger, its tissues more rigid, the body a little more globular, the cervix shorter in comparison with the length of the body, and the os externum transverse instead of circular, and perhaps enlarged by lacerations of the cervical tissue. The changes which occur during involution in the various structures of which the uterus is composed are as follows:—

The Peritoneum.—The peritoneal covering of the uterus, which was at first wrinkled, owing to the smaller extent of surface to which it had to adapt itself after the emptying of the uterus, gradually returns to its normal condition as the temporary hypertrophy of pregnancy disappears.

The Uterine Muscle.—The changes which take place in the uterine muscle are well marked and considerable. Their exact nature cannot be regarded as having been definitely settled, but they are in great part, or altogether, due to the deprivation of blood, resulting from the obliteration of many of the vessels in the uterine wall by retraction, and possibly by the compression of the supplying vessels external to the uterus by the weight of the latter (Webster*). The large muscle fibres which are found in pregnancy disappear, and in their place is found the ordinary unstriped fibre of the unimpregnated uterus. 1 According to many authorities (Winckel, Kolliker), some of the fibres undergo a fatty degeneration and disappear, whilst others atrophy but persist as smaller fibres. This explanation, which used to be more or less universally held to be correct, has of recent years been disputed. 2 Helme,[*] who has investigated the changes in rabbits, states that fatty degeneration of the muscle never occurs, but that the process is one of atrophy, which results in a diminution in the bulk of the fibres, probably by a process of solution. He further believes that there is no production of new fibres, as there is no karyokinesis. 3 This tends to support a former view expressed by Fischer,[†] who considered that the alteration in size of the uterus was due to the conversion of the muscle albumin into a soluble modification such as peptone, which was then in part excreted from the blood by the kidneys, and in part carried away in the lochia. It is also probable that some of the products of solution are carried away in the lymph stream. 4 According to Spiegelberg and others, new muscle fibres are developed from the embryonic cells in the connective tissue, but this is at variance with the observations of Helme. 5 Sänger, on the other hand, after careful examination, determined the presence of fatty degeneration affecting a portion of the protoplasm, but nowhere was he able to find any fatty detritus outside the muscle fibre. He believes that the important changes in the fibres are due to a hyaline and finely granular degeneration, and that, while there may be slight fatty degeneration as well, when it is extensive it is pathological. He further considers that the products of degeneration are for the most part oxidized where they are, and do not find their way into the maternal blood. On the whole, Helme's view is probably the one most likely in the present state of our knowledge to be correct.

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* Text-book of Obstetrics,' p. 256, 1903.

The Mucous Membrane.—The changes which occur in the uterine mucosa result in the disappearance of the remains of decidua left behind after delivery, and in the regeneration of the normal mucous membrane. As has been mentioned, a considerable amount of the spongy portion of the decidua serotina remains adherent to the placental site, while the rest of the uterus is irregularly covered by the remains of the deeper layers of the decidua vera. This layer contains fragments of glands, in the deeper parts of which the epithelium still persists, and of interglandular tissue. The glands also penetrate for a short distance into the muscular coat. The superficial parts of the deeper layer in turn undergo degeneration, and are carried away in the lochia, with the result that the surface of the uterus again becomes smooth. Then, according to Leopold,[‡] the remains of the glands commence to increase in length and their epithelium proliferates, until at about the end of the third week the latter reaches the level of the uterine wall. Finally, about the fifth to the eighth week, the epithelial lining of the uterus is complete. The placental site is at first covered by the remains of decidua serotina, and, consequently, is slightly raised. As involution continues, the site diminishes in size, but bulges rather more towards the uterine cavity—a change which is probably due to the formation of thrombi in the placental sinuses. The covering layer of decidua degenerates, and the mucous membrane is restored, as in the case of the other portions of the uterine wall.

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[*] *Trans. Royal Soc. Edin.*, vol. xxxv., part ii.

[†] *Archiv f. Gyn.*, vol. xxiv., p. 400; vol. xxvi., p. 120.

[‡] *Ibid.*, vol. xii., p. 169.

The Bloodvessels.—The arteries of the uterus gradually diminish in size, probably as a result of the compression they undergo, but a permanent thickening of their walls persists. Some of the smaller vessels are obliterated by a progressive proliferation of the connective tissue of the intima, the muscular coat disappearing as a result of hyaline or fatty degeneration. Many of the capillary vessels are completely removed by hyaline degeneration. The uterine sinuses are filled by thrombi, some of which appear at the time of delivery, and others several days, or even several weeks after delivery. The subsequent changes which take place in the sinuses very closely resemble what occurs in a corpus luteum. The endothelium proliferates and is thrown into folds, which, as they increase in size, occupy more and more of the cavity. The thrombus gradually shrinks and becomes decolourised, and finally, perhaps, its remains become organised by the outgrowth into them of connective-tissue cells and capillary vessels. At the end of six weeks there is little trace of the former sinus, save the convoluted appearance of the lining membrane and small crystals of hæmatoidin.*

The Lochia.—The lochia (λόχιος, of, or belonging to, childbirth), the lochial discharge, or the cleansings are the terms applied to the discharge which comes from the uterus during involution. The old and classical description of the lochia must be considerably modified as a result of the alterations which have been brought about in their character by the practice of aseptic midwifery. In the past it has always been customary to describe three forms of lochia—the *lochia rubra* or *cruenta*, which lasted for the first three days; the *lochia serosa*, which lasted until the sixth or seventh day; and the *lochia alba* or *lactea*, which persisted up to the end of the second or third week. The lochia alba or lactea may in reality, as Giles points out, be considered as identical with the 'laudable pus' of pre-antiseptic days, and consequently as non-existent in the course of an aseptic puerperium. There is no advantage in adhering to this old description, and we may consider the lochia as a wound discharge consisting of blood and serum, to which is added fragments of decidua and membranes—

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* *Vide* also a paper by Sir J. Williams, 'Changes in the Uterus resulting from Gestation,' *Trans. Obstet. Society*, vol. xx.

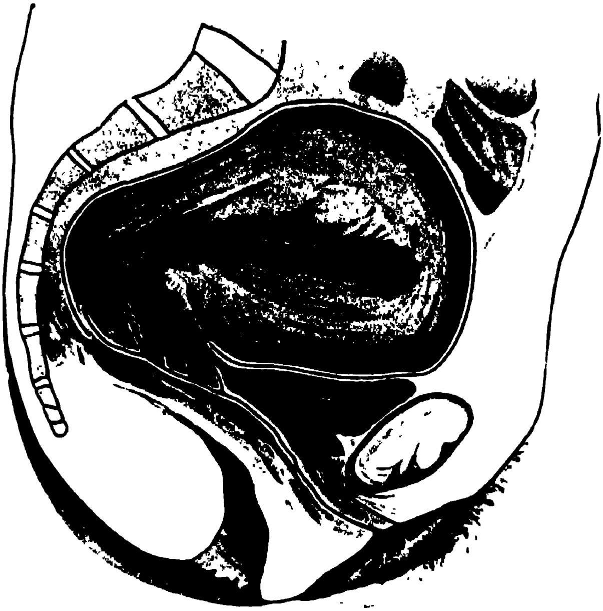

PLATE VI.—MESIAL SAGITTAL SECTION OF A WOMAN WHO DIED THIRTY-SIX HOURS AFTER DELIVERY. (Webster.)

[*To face p.* 444

the products of the degeneration of decidual tissue, and mucus from the cervical glands. At first, the discharge consists of almost pure blood, owing to the large extent of wound surface, and to the incomplete obliteration of the bloodvessels. Later, the blood gradually lessens and the discharge becomes sero-sanguineous, and, finally, the blood disappears, and the discharge consists of a purely serous transudation. Consequently, we may expect in a normal puerperium to find the pads which are placed over the vulva at first soaked by almost pure blood, then stained with bloody serum, and, finally, by serum alone. Whether bacteria are necessarily present or not in the lochia is a question which has given rise to considerable discussion, and which we have already in part answered. It may, we think, be stated that, if the patient was previously healthy and the labour normal, the vagina will be sterile after delivery. That, if the parts are kept thoroughly cleansed and protected by a sterile covering during the puerperium, the lochia will remain aseptic. That, if the vulva is not protected by a sterile covering, but all source of infection is avoided, the lochia will contain non-pyogenic bacteria and saprophytes, which have entrance by direct upward extension. Finally, that, if pyogenic bacteria are allowed to gain entrance either by indirect extension from without or by direct introduction on the fingers or instruments, they will be found in the lochia, and the characters of the latter will be altered in correspondence with the nature of the infecting bacterium.

The quantity of lochia, which was formerly considered to be physiological, is considerably in excess of the actual quantity in an aseptic case. The statistics of Gassner,* which have usually been accepted in the past, are as follows:—

Variety.	Duration.	Amount.
Lochia rubra	1st to 3rd day.	35 oz 4 4 drms.
Lochia serosa	4th to 5th day.	9 ,, 14 ,,
Lochia alba	6th to 8th day.	7 ,, 3 6 ,,
Total	1st to 8th day.	52 oz. 6 drms.

Gassner further stated that, if the patient nursed, the average loss was less, and averaged 38 ounces 4 drams; while if she did not nurse the loss was greater, and amounted to 66 ounces 5 drams. These figures are manifestly too high, and, curious as it seems, were based on the examination of only two cases, so that it is quite time that they are no longer quoted as correct in text-books.

Giles† has made a series of investigations in sixty patients in whom the puerperium was normal, and in whom he measured the amount of lochia with due precaution to avoid errors. His results differ considerably from those of Gassner, and are as follows:—The smallest amount of lochia in any case was two ounces, the greatest amount twenty-four ounces. In thirty cases, or 50 per cent., the quantity was ten ounces or less. In nine cases, or 32 per cent., the quantity was ten to fifteen ounces. In eight cases, or 13 per cent., the quantity was fifteen to twenty ounces. In three cases, or 5 per cent., the quantity was over twenty ounces. The average quantity of all the cases was 10·89 ounces, and if the three cases in which the amount was over twenty ounces are excluded, the average of 95 per cent. of the cases is about 10½ ounces. The duration of the discharge was found to be as follows:—

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* *Monatssch. f. Geburts.*, vol. xix., p. 51

† 'Encycl. Medica,' vol. x., p. 138.

Number of Cases.	Duration in Days.	Number of Cases.	Duration in Days
4	5	11	9
4	6	6	10
10	7	7	11
11	8	6	12
		1	14

These figures show an average duration of 8¾ days. Further, Giles did not find that the quantity of lochia was considerably increased in the case of women who did not nurse their infant. In fifty-three women who nursed, the average quantity was 11·2 ounces; in seven women who did not do so, the average was 10·3 ounces. The age and parity of the patient did not appear to affect the quantity. On the other hand, the latter varied directly with the weight of the infant, and especially with that of the placenta, with the amount of blood lost at the time of labour, and with the habitual amount of the menstrual flow. It was also greater in the case of dark than fair patients.

The Weight and Size of the Uterus.—The effect of involution on the uterus is, as has been stated, to bring about a marked reduction in its weight and size. The weight of the uterus after delivery varies within wide limits according to the individual tendencies, and this, in all probability, accounts for the rather different figures which are given by observers, who state its weight to be from 1 pound 10·5 ounces (Börner*) to 3¼ pounds (Varnier†). At the end of two days the weight has fallen to an average of one and a half pounds, at the end of a week to a pound, at the end of two weeks to three-quarters of a pound, while by the end of the sixth week the normal weight of 9 or 10 drachms is reached (Heschl).

The various alterations in the vertical measurements of the uterus as collected by Giles‡ are as follows:—

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* 'Ueber den puerperalen Uterus.' Graz, 1875.

† 'La Pratique des Accouchements.' Paris, 1900.

‡ *Op. cit.*

Day.	Cervix.	Body.	Whole Uterus.	Cavity.
1st			8 inches	7 inches
2nd	2⅛ inches	4⅞ inches	7 ,,	6⅛ ,,
3rd	2 ,,	4⅜ ,,	6⅞ ,,	5⅜ ,,
4th	2 ,,	5⅛ ,,	7⅛ ,,	6¼ ,,
6th	1⅝ ,,	3½ ,,	5⅛ ,,	4⅞ ,,
15th	1¼ ,,	2½ ,,	3¾ ,,	3⅜ ,,

he height of the uterus above the symphysis is of more practical nportance than the measurements we have just given, inasmuch s clinically it is the means by which we judge of the rate of volution. The average height in inches, as determined by tevens and Griffith* during the twelve succeeding deliveries, is s follows:—

Day.	Height above Symphysis.	Day.	Height above Symphysis.
1st	5¼ inches	7th	3¼ inches
2nd	5 ,,	8th	3⅛ ,,
3rd	4⅜ ,,	9th	2⅞ ,,
4th	4⅓ ,,	10th	2¾ ,,
5th	4 ,,	11th	2⅓ ,,
6th	3½ ,,	12th	2⅙ ,,

In measuring the height of the uterus we must first ascertain that the bladder is empty, and, if possible, the rectum, and that the uterus is lying in a mesial plane, and is not unduly deflected to one or other side. A full bladder or a distended rectum will push the uterus upwards, while, if the uterus is deflected to one or other side or markedly ante- or retro-verted, the fundus will lie at a lower level than would be the case if these deviations were corrected. As it is impossible to remember a list of figures such as the above for clinical purposes, it is well to know that about the fourth day the fundus should be at or just below the level of the umbilicus, while by the tenth day it should lie behind the symphysis, the posterior surface of the body occupying the plane of the brim. On the fifteenth day it is an entirely pelvic organ (Webster).

The Appendages and Ligaments.—As we have already seen, the outer extremities of the tubes do not alter their position to any great extent during pregnancy, and, consequently, as the uterus enlarges the tubes come to lie vertically in the abdomen. This position is maintained during the first few days of the puerperium, and gradually as the uterus returns to its normal size the tubes regain their normal more or less horizontal position. The tubes and ligaments undergo a process of involution identical with that of the uterus, and, when this process is complete, they occupy very much the same relations to the uterus as before impregnation.

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* 'Variations in the Height of the Fundus Uteri above the Symphysis,' etc. *Obst. Trans. London*, vol. xxxvii., p. 246.

The Vagina.—The vaginal canal after delivery is soft and dilated, and in the case of primiparæ is frequently lacerated in its lower part. At the end of two to four weeks, according to the rate at which involution takes place, it has regained its normal size, but some increase in size probably always persists, especially at the vulvo-vaginal junction.

The Perinæum and Pelvic Floor.—The involution of the perinæum is complete in about fourteen days. Lacerations and abrasions, if correctly treated, will also heal within the same period. The projection of the pelvic floor, which we know to occur during pregnancy, is even more marked about the fourth day of the puerperium than it was previously. According to Webster, it is as follows:—First day, 2 inches; second day, 1⅞ inches; third day, 1⅝ inches; fourth day, 2⅛ inches; sixth day, 1½ inches; fifteenth day, 1 inch.

CHANGES IN THE BREASTS.

As lactation is establishing itself, the breasts become swollen and tender, the superficial veins engorged, and frequently the axillary glands enlarged. Histologically, the following changes have been noticed. The alveoli of the glands are found to be lined with cells, which are cubical or columnar according as they are distended or collapsed, and within the distended alveoli is found, in prepared specimens, a finely granular material formed by the coagulation of caseinogen. In some of the cells, more than one nucleus is present, but karyokinetic figures and cell division do not appear to occur more frequently than in the non-lactating condition. Within many of the cells, oil globules can be distinguished, and in some alveoli the central end of the cells presents a ragged appearance, suggesting that this part of the cells themselves breaks down to form the solids of the milk. It is probable, however, that this does not actually occur, but that the milk is a true secretion formed by, and passed out from, the cells without any breaking down of cellular substance taking place. In the early days of lactation, cells distended with fat globules, and known as colostrum corpuscles, are found in the milk. These were formerly regarded as desquamated alveolar cells, but it is now almost universally believed that they are really migrated leucocytes.

Colostrum is the term applied to the fluid which comes away in the first forty-eight hours after delivery, or, perhaps, it would be more correct to say, from the time of delivery until the secretion of the true milk is established. It is of a deep yellow colour, due to the presence of colostrum corpuscles, is strongly alkaline in reaction, and coagulates into a solid mass if heated and sometimes even coagulates spontaneously. The fat globules are of

very unequal size, and the number of colostrum corpuscles present is considerable. As will be seen by comparing its analysis with that of human milk, it contains a considerably larger quantity of proteid matter, and only slightly more than half the proportion of fat and sugar. The laxative effect which it produces on the infant is said by Winckel* to be due to the presence of calcium phosphate, magnesia, and sodium and potassium chloride. The colostrum corpuscles disappear in from three to five days.

The secretion of the true milk commences, as a rule, on the third or fourth day after delivery, and in a few cases a little earlier or later, as is shown by the following table (M'Cann and Turner):—†

Secretion commences on the	1st day	in	1	per cent. of cases.
,, ,, ,,	2nd	,,	5	,, ,,
,, ,, ,,	3rd	,,	46	,, ,,
,, ,, ,,	4th	,,	39	,, ,,
,, ,, ,,	5th	,,	6	,, ,,
,, ,, ,,	6th	,,	1	,, ,,
,, ,,	after the 6th	,,	2	,, ,,

The average daily quantity of milk secreted is difficult to ascertain with certainty, and differs considerably in different women, and in the same woman according to the demand made upon her by the infant. The following table has been compiled by Holt‡ from observations made in five cases, in all of which the infants were healthy, were exclusively breast-fed, and gained steadily in weight:—

Period.	Average daily quantity.
End of 1st week	10 to 16 ounces
During 2nd week	13 ,, 18 ,,
,, 3rd ,,	14 ,, 24 ,,
,, 4th ,,	16 ,, 26 ,,
From 5th to 13th week	20 ,, 34 ,,
,, 4th ,, 6th month	24 ,, 38 ,,
,, 6th ,, 9th ,,	30 ,, 40 ,,

The composition of human milk and of colostrum will be discussed in another place.

CHANGES IN THE ORGANISM IN GENERAL.

The various general changes which occur during the puerperium will be considered under their proper heads.

The Circulatory System.—The hypertrophy of the heart, which usually occurs during pregnancy, gradually disappears, and the apex-beat returns to its normal position. In a considerable proportion of cases a modification of the first cardiac sound, which is replaced by a soft blowing murmur, can be noticed. This occurrence was first detected by Money, and was found by Dakin in 57 out of 100 cases specially examined at the General Lying-in Hospital. It is probably associated with the involution of the cardiac muscle.

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* *Op. cit.*, p. 201.

† 'Occurrence of Sugar in the Urine during the Puerperium,' *Obst. Trans. Lond.*, vol. xxxiv., pp. 473-487.

‡ 'Diseases of Infancy and Childhood,' p. 128. Cases recorded by Hæbner (3), Laure, and Ahlfeld.

The pulse of the parturient woman is, as a rule, slower than the normal, but not perhaps to the extent that was at one time considered to be the case. Considerable differences of opinion have been expressed as to the alteration of rate which occurs. Olshausen* found a pulse-rate of below 60 in 63 per cent. of cases. Spiegelberg† stated that 'the pulse-rate, which has increased during labour, diminishes immediately after it, then rises again, and on the second, third, or fourth day becomes markedly slowed. The rate then varies between 44 and 70; indeed, a frequency of less than 40, even of 30, has been noticed. The usual figures are 44, 48, and 56.' This statement was, however, challenged by Probyn-Williams and Cutler,‡ who found that in 100 cases examined at the General Lying-in Hospital the average rate was never lower than 73, and oftener nearer 80 than 70. The pulse of a puerperal woman is readily influenced by conditions which at other times would produce little or no effect, and, consequently, alterations in its rate are of frequent occurrence, and the difficulty of obtaining the correct average rate is considerable. It is more than probable that a slight degree of slowing generally occurs, and that whereas the average pulse-rate varies in pregnancy between 70 and 80, the average pulse-rate in the puerperium is between 60 and 70. The causes which produce this slowing have been variously stated to be altered innervation of the cardiac muscle, 2 increased arterial tension, the horizontal position of the patient, 4 the presence of fat in the circulation due to absorption from the uterus, and 5 the impoverishment of the blood from hæmorrhages during labour. A probable cause would seem to be the re-action of the system generally from the increased strain imposed upon it by pregnancy and labour; but, inasmuch as slowing has been noticed after a four months' abortion, some other cause or causes must also be at work.

The blood is said to contain a larger proportion of fibrin and white blood corpuscles than during pregnancy. This increase reaches a maximum twelve hours after labour, and has been termed a physiological leucocytosis.

The Temperature. — It cannot be too plainly and definitely stated that, though the puerperal woman is subject to slight variations of temperature, the average temperature differs but little, if at all, from the normal. Temporary variations of temperature, reaching, perhaps, as high as 100·5° F., may occur, for which it is difficult to find a cause; but for temperatures above that a cause can be found in almost every case. Up to comparatively recent times, it was a common belief that a physiological elevation of temperature, reaching 101° F., or higher, occurred on the third or fourth day in association with the establishment of lactation. To this condition the term 'milk-fever' was applied, and in consequence of the general belief in its physiological nature, local septic conditions of the genital tract were overlooked. A rise of temperature of from 0·5° F. to 0·8° F. during the first twelve hours after delivery is perhaps the rule, and this rise is most marked when the hours of 4 p.m. to 8 p.m. fall within this period — that is to say, when the post-parturient rise corresponds with the ordinary evening elevation of temperature.

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* 'Ueber die Pulsverlangs. im Wochenbette,' etc., *Cent. f. Gyn.*, 1881. Nr. iii. 3, pp. 49-53.

† 'Text-book of Midwifery,' New Sydenham Society's edition, vol. i., p. 289.

‡ 'Some Observations on the Temperature,' etc., *Trans. Obstet Soc. Lond.*, vol. xxxvii., pp. 26, 29.

The Urinary System.—The secretion of urine during the first days of the puerperium is increased, and averages about 2,020 grammes in the twenty-four hours. This increase affects in the main the water, as there is little or no increase in the amount of solids excreted. The amount of urea, sulphates, and phosphates is actually diminished during the first two or three days, increases slightly about the fourth day, and then again progressively diminishes. The chlorides are considerably increased (Winckel). The specific gravity, which at first varies between 1,010 and 1,018, reaches a maximum of about 1,022 on the fourth day. The presence of sugar in the urine, which at one time was considered doubtful, is now generally admitted. Hofmeier and Kaltenbach* were the first to demonstrate that it occurred as lactose, and so to prove the intimate connection between its presence and lactation.

This connection has been still further cleared up by MacCann and Turner.† Their investigation of 100 cases showed that lactosuria occurred in all after lactation had started, and that the average quantity of sugar was about 1½ grains to the ounce. Excessive production of milk or diminished outflow resulted in an increase in the quantity, while as soon as production and withdrawal from the breast became equal the amount of sugar in the urine became constant. Although the quantity of milk affects the amount of lactose, the quality does not, and, consequently, the proportion of lactose is not, as was at one time stated, a guide to the suitability of a wet-nurse.

The presence of peptone in the urine during the puerperium has also been determined (Fischer‡), and would appear to be fairly constant. It appears about the second or third day after delivery, the proportion increases up to the fourth day, and then diminishes gradually until it disappears about the tenth or twelfth day. Its presence is probably connected with the changes which occur in uterine muscle fibres during involution.[7] Small quantities of acetone have also been found in the normal puerperal urine—a fact of some importance, in view of the statement that such an occurrence prior to delivery indicated the death of the fœtus (Vicarelli,* Knapp†).

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* *Zeits. f. Geb. u. Gyn.*, vol. iv., p. 161. † *Op. cit.* ‡ *Ibid.*

The Digestive System.—The appetite of the patient for the first two or three days is usually somewhat diminished, but from that time on, as the demands made by lactation produce their effect, it increases. Thirst is usually keen from the first, in consequence of the loss of blood during labour, and later as a result of lactation. The bowels are almost always confined, and it is but rarely that a movement will occur during the lying-in unless brought about by a purgative or enema. This is due in part to the relaxed abdominal walls and the lowered intra-abdominal tension, in part to the recumbent position and lack of exercise. Digestive troubles, nausea, etc., which may have caused considerable annoyance during the end of pregnancy, usually disappear with the expulsion of the fœtus.

In consequence of the increased action of the kidneys and skin, of the involution of the uterus, and of the diminished ingestion of food, there is a distinct loss of weight in a puerperal woman during the first eight days, and this has been found to amount to an average of 10 pounds (4,571 grammes, Gassner‡). This loss of weight was considered by Winckel to be abnormal, and partly due to insufficient diet; but a series of experiments made by Baumm§ at Munich showed that a loss of weight of from 1,700 to 6,500 grammes (3 pounds 11 ounces to 14 pounds 5 ounces) normally occurred, and that the average loss was 7 pounds 8 ounces. Further, multiparæ, and those who nursed frequently, lost more than primiparæ and non-nursing women. the greater the weight of the individual the greater was the loss, and after twins it was more marked than after single pregnancies.

It is interesting to compare with these figures the loss of weight during labour. The following figures are also the result of Baumm's researches, and are based on sixty cases:—

The fœtus - -	3,265	grms.	(7 lb. 3 oz. approx)
Placenta - - -	628	,,	(1 lb. 6 oz 2 drms approx.)
Liquor amnii -	1,300	,,	(2 lb 13 oz. 13 drms approx)
Blood - - -	308	,,	(10 oz. 13 drms. approx)
Excrementa - -	366	,,	(12 oz. 14 drms. approx.)
Evaporation from lungs and skin - -	375	,,	(13 oz 3 drms. approx.)
Total loss during labour	6,242	,,	(13 lb 12 oz. approx.)
Total loss during puerperium - -	3,399	,,	(7 lb 8 oz. approx.)
Total loss from commencement of labour to end of puerperium	9,641	,,	(21 lb. 4 oz approx.)

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* *Prag. Med. Wochensch.*, 1893.

† *Cent f Gyn.*, 1897, p. 417.

‡ *Monatssch. f. Geburts.*, vol xix., p 47

§ I., D., Munchen, p. 18

The Respiratory System and Skin.—The rate of respiration is slightly, if at all, affected during a normal puerperium. Immediately after delivery it averages from 14 to 20, and during the puerperium, according to Probyn-Williams and Cutler,[*] the average rate is from 20 to 22.

The skin acts freely during the puerperium, and is a valuable adjunct to the eliminatory functions of the kidney. The pigmentation of pregnancy passes off within a few weeks, and the red striæ gravidarum gradually change into lineæ albæ. In a certain proportion of women (27 out of 377, Champneys) lumps appear in the skin of the axillæ towards the end of pregnancy, and are especially noticeable during the puerperium. These lumps vary in size from "the smallest possible" to that of an egg or a little larger. If they are squeezed during the puerperium, granular débris like the secretion of sebaceous follicles is expelled through their ducts, and is followed by a substance resembling colostrum, and, finally, by what appears to be milk. The secretion does not flow naturally from them, as happens in the breast. It was at first considered that these lumps were modified sebaceous glands, but they have more recently been found to be modified sweat-glands.[†] They are situated in the skin, and in half the cases occur bi-laterally. Their course of enlargement follows that of the breast, and sometimes they may again become swollen and slightly painful during subsequent menstruations.

The Abdominal Walls.—The abdominal walls have of necessity become considerably stretched during pregnancy, and consequently after delivery are flaccid and wrinkled. Under ordinary circumstances this condition passes off to a great extent during the first two months after delivery. A certain amount of laxity and wrinkling, however, always persists after the first pregnancy. If there has been excessive overdistension, or if the woman has had many previous pregnancies, the recti muscles may become separated in consequence of the stretching of the common tendon of the internal oblique and the transversalis muscles. As a result of this, the intestines bulge between the separated muscles whenever the woman strains, and, if the lateral muscles of the abdominal wall are also overstretched, a pendulous abdomen results. The striæ gravidarum, which occurred during pregnancy, gradually lose their reddish colour and become white, scar-like lines—lineæ albæ.

The Pelvic Joints.—The relaxation of the pelvic joints which occurs towards the end of pregnancy, and which permits of the occurrence of a slight range of movement in the joints, gradually passes off and the latter regain their former rigid condition.

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[*] *Op. cit.*

[†] 'On the Development of Mammary Functions by the Skin of Lying-in Women,' by F. H. Champneys, *Med. and Chir. Trans.*, vol. lxix., p. 419; *Trans. Obstet. Soc. Lond.*, vol. xxxii., p. 117; and Champneys and Bowlby, *Med. and Chir. Trans.*, vol. lxxviii.

Symptoms.—The symptoms or subjective phenomena of a normal puerperium are slight. As soon as labour is complete the patient experiences a sense of relief which is in marked contrast to her former pain-harassed condition. During the days of the lying-in, the patient is in a state of general comfort and well-being, to which, for the last month of pregnancy, she had been a stranger. The first desire is, perhaps, for a drink, as the loss of blood during the third stage increases the thirst which suffering causes. Then, an hour or so after delivery, a desire for food asserts itself, and during the entire puerperium, as has been said, the appetite is good. As a rule, the patient experiences a desire to micturate during the first twelve hours after delivery, or, at any rate, will be able to empty the bladder when the necessity for so doing is pointed out to her. In a not-inconsiderable proportion of cases, on the other hand—especially amongst primiparæ—not only is there no desire to pass water, but even the act of so doing is for some hours impossible. The causes of such a condition are readily understood. The bruising which the urethra undergoes during delivery, especially amongst primiparæ, causes a tenderness which renders the patient reluctant to try to empty the bladder, and also, in some cases, produces a temporary paralysis of the sphincter. Further, the diminished intra-abdominal tension and the relaxed condition of the abdominal muscles render the emptying of the bladder difficult, even if relaxation of the sphincter is obtained. Observations made upon 224 women who were confined at term in the Clinic Baudelocque (Recht*) gave the following results:—

51	women, or	22 76	per cent ,	passed water	in the first 6 hours.				
79	,,	35·26	,,	,,	between the	7th	and the	12th	hour
46	,,	20·54	,,	,,	,,	13th	,,	18th	,,
33	,,	14·75	,,	,,	,,	19th	,,	24th	,,
15	,,	6·69	,,	,,	,,	25th	,,	36th	,,

As it is usually taught that it is inadvisable to allow a patient to remain more than twelve hours without having emptied the bladder, the above table shows that 94 of the patients, or 41·98 per cent., required assistance, and this figure is made up of 59·21 per cent. of the primiparæ and 27·27 per cent. of the multiparæ upon whom the observations were made. The high proportion amongst primiparæ is accounted for by the fact that in their case labour is more prolonged and the bruising to which the parts are subjected is more severe.

5 The bowels seldom act of their own accord so long as the woman is in bed, in part due to the effect of the recumbent position, and in part the result of the relaxed condition of the abdominal walls and the lowered intra-abdominal pressure.

6 Occasional pains due to contractions of the uterus are of not infrequent occurrence, and are known as after-pains. Contractions of the uterus occur, in all probability, during a considerable part of

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* Thése de Paris, 1894.

the puerperium, but only occasionally are they so well marked as to give rise to pain. If the length of labour is normal, and if the uterus contracts well during and immediately subsequent to the third stage, after-pains rarely occur. If, on the other hand, labour is short, and if incomplete contraction and retraction allows the accumulation of clots in the uterus, after-pains are of common occurrence. Accordingly, as would be expected, they are usually absent in primiparæ and of common occurrence in multiparæ. They are usually most marked on the evening of the first day, and in some cases they may persist for several days. When the infant is put to the breast they become momentarily worse, owing to the increased contraction of the uterus caused by suckling.

The enlargement of the breasts and the establishment of lactation are usually associated with slight stinging pains in the breasts, and of continuous and severe pain if overdistension occurs. If the child is very vigorous, its efforts at suckling may often cause considerable pain and sometimes laceration of the tender skin about the base of the nipples.

When the patient is allowed up for the first time she almost invariably suffers from a degree of muscular weakness the existence of which she did not suspect when in bed. This, however, soon passes off, and in a comparatively short time afterwards she regains her habitual strength and energy. If, after she has returned to her ordinary mode of life, she still suffers from weakness and lassitude, there is always some pathological condition present whose nature should be determined and whose cause, if possible, removed.

Diagnosis.—It occasionally happens that in legal cases it may be necessary to determine whether recent delivery has occurred or not. In these cases, the statements of the woman concerned possess only a negative value, and the diagnosis must be made from the more positive information obtained from the physical examination of the patient. The signs upon which we rely for a diagnosis can, as in the case of pregnancy, be divided into three classes—doubtful, probable, and certain.

The doubtful signs are to be found in the relaxed and wrinkled abdominal wall, the presence of striæ or lineæ albicantes, of pigmentation, and of varicose veins.

The probable signs consist in lacerations about the perinæum cervix and vagina, and in the dilated vagina, the enlargement of the uterus, the patulous condition of the cervix, the dilated and relaxed lower uterine segment, the dilated uterine cavity, the roughened area corresponding to the placental site, the swollen and secreting breasts, and the lochial discharge.

The certain signs are the foregoing, when occurring in conjunction and gradually altering within a short period in the manner previously described. Further, the presence of a portion of placenta or membrane in the vagina, or attached to the placental site, is *per se* a certain sign.

CHAPTER II

THE MANAGEMENT OF THE PUERPERIUM

The Maintenance of the Normal Functions of the Body—Digestion—The Bladder—The Rectum The Promotion of the Functions Peculiar to the Puerperium Involution—The Use of Vaginal Douches—Lactation General Points in Treatment Prognosis.

THE management of the puerperium may be stated in a few words to consist in attention to the following points:—

(1) The maintenance of the ordinary functions of the body.

(2) The promotion of the functions peculiar to the puerperium —*i.e.*, involution and lactation.

THE MAINTENANCE OF THE NORMAL FUNCTIONS OF THE BODY.

The functions of the body, to which attention must be particularly directed during the puerperium, are the digestive functions and the functions of the bladder and rectum.

Digestion.—The food of a puerperal woman must be simple, sufficient, and appetising. At a time when the system in general is recovering from the strain which has been placed upon it during the previous nine months and is accustoming itself to the performance of new duties, the organs of digestion must not be overtaxed by food which is difficult of assimilation, and, accordingly, the food given to the patient must be simple. When the woman is up and able to take a due amount of exercise, a correspondingly simple but more varied dietary may be allowed. At all periods of the puerperium, the amount of food must be sufficient. The older notions that a low diet was required at this time, have in the words of a recent writer been consigned to the same limbo of defunct prescriptions as the 'starve a fever' principle. A puerperal woman, more than other people, requires the maximum amount of nourishment which she can digest without imposing too great a tax on her digestive organs, and in this respect the inclinations of the patient may be taken as a guide. For the first two days, light nutritious and liquid food is all that is required, the only solid food for which the patient, as a rule, cares being toast or rusks, or a light milk pudding. On the third day, if the bowels have acted, food of a more solid nature may be given in small quantities, and supplemented as required by liquids. From this onwards, the dietary becomes more liberal, but, so long as the patient remains in bed, her meals should be given at short intervals and small amounts of food only be taken at a time. All food should be prepared in such a manner as to be appetising, as, even if the appetite is good, the squeamishness and nervous excitability of pregnancy will not have sufficiently passed off to enable the patient to consume the necessary quantity of food when the dietary is untempting. For this reason, there should be considerable variety in the food.

It is unnecessary to enter into many particulars with regard to the exact dietary adopted, as there are such wide limits within which it may vary in individual cases. The general principles which govern it will be gathered from the preceding paragraph, and from the following:—During the first two days, the patient should receive some nourishment every three hours during the day. Beef-tea, milk, chicken-tea, gruel, tea and toast, an egg well beaten up, and a light pudding composed of egg and milk, may in turn be given and will furnish sufficient variety. If the patient proposes to nurse the infant, abundance of milk in different forms must be given. If she is not going to nurse the infant, the amount of milk is best restricted. On the third to the fifth day, the woman usually experiences a desire for solid food. As a Continental writer says, 'the English puerpera eats her beefsteak at this time with great relish,' and if for 'beefsteak' we substitute a small piece of fresh fish, of chicken, or of mutton chop, she not only relishes the change, but is considerably benefited by it. From this on, the interval between the meals may be increased, but an interval of four hours should not be exceeded.

The use of alcoholic beverages as stimulants is only necessary when the patient is in a weak condition from previous ill-health or hæmorrhage. As a food or tonic, however, and particularly in the case of a woman who is nursing, the use of sound claret, burgundy, or stout may be permitted, and in some cases will enable a patient to nurse who might not otherwise have been able to do so.

The Bladder.—Attention to the bladder is one of the most important duties of the nurse during the first twenty-four hours after delivery. In no case should a parturient woman be allowed to pass more than sixteen hours without emptying the bladder, in spite of what has been written by Varnier to the contrary effect. According to the statistics which we quoted in the previous chapter, forty-two per cent. of women will not pass water within the first twelve hours of their own accord, and, consequently, in all these cases steps must be taken to ensure that the bladder is emptied. To this end, after twelve hours have elapsed, warm stupes may be placed over the pubes, as this often produces the required effect. If this is unsuccessful, the patient may be cautiously turned on her hands and knees, always providing that there is no laceration of the perinæum nor cardiac weakness. If this still is unsuccessful, and if the bladder is not unduly distended, as ascertained by abdominal palpation, the patient may wait for three or four hours longer, and then, if the application of stupes and alteration of the position still fail, the catheter must be passed. At the present day it is hardly necessary to insist upon the fact that there is but one manner in which the catheter may be passed, and that the old method, in which carefully acquired skill was used to pass the catheter under the bed-clothes, is so incongruous in view of the elaborate aseptic precautions which are taken at other times, that it can no longer be adopted by anyone capable of reasoning. In all cases the parts must be exposed, the vulva, especially round the orifice of the urethra, carefully washed with an antiseptic lotion in order to remove all discharge, etc., and the catheter then passed under the guidance of the eye directly into the urethra without touching the surrounding parts. A glass or metal female catheter, which has been boiled for five minutes, should be used.

The use of the catheter must not be continued beyond the second day, as, in the first place, the patient may get into a habit which will be difficult to break her off, and, in the second place, the risk of infecting the bladder is greater after the second day on account of the presence, on the external genitals, of lochia, which may be decomposing, and all traces of which it is difficult to remove. By this time, the patient may be allowed to kneel up in bed, or even to stand by the side of the bed, and in this way it will be almost always possible for her to empty the bladder of her own accord.

The Rectum.—Aperient medicine may be given on the evening of the second or the morning of the third day after delivery. Its administration is required in almost every case, for the reasons that have been already stated. Castor-oil is the most commonly used drug and possesses certain advantages, but it is very nauseating, and, consequently, many patients cannot take it. As a substitute may be given Pulv. Glycyrrhizæ Co., Cascara Sagrada, Sulphate or Citrate of Magnesium, or, in fact, whatever purgative the patient is accustomed to take. If a motion does not result, a soap and water enema may be administered. A mild aperient must also be administered every second day during the puerperium, if the bowels do not act without it.

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THE PROMOTION OF THE FUNCTIONS PECULIAR TO THE PUERPERIUM.

The functions peculiar to the puerperium are involution and lactation. They are both to a considerable extent promoted by proper attention to diet and to the action of the bladder and bowels, but there are also other means by which their course can be favourably affected and to which we shall now refer.

Uterine Involution.—The two most important factors in the production of perfect uterine involution are the proper management of the third stage of labour and the maintenance of uterine asepsis. The former has been already discussed. Its importance consists in the fact that a well-managed third stage means that the patient commences her puerperium with an empty and well-retracted uterus, and that thus two of the most common causes of sub-involution (insufficient involution)—uterine congestion and the presence of pieces of placenta or bloodclot—are non-existent.

The maintenance of uterine asepsis is even more important. At the commencement of the puerperium the uterus and vagina, in a normal patient in whom no examinations have been made after the birth of the child, have been proved to be aseptic, and, accordingly, in all cases in which bacteria are subsequently found in the genital canal they must have gained admission from the outside. Septic bacteria will, in all probability, only gain admission on septic fingers or instruments passed into the vagina, but saprophytic bacteria, or some of the many non-pathogenic bacteria which are frequently found in the lochia, may gain entrance into the vagina by direct extension upwards from a nidus in decomposing lochia on the vulva or bedclothes. Accordingly, we see that if the vagina is to be kept free, not only from septic, but also from saprophytic bacteria, it is not sufficient to merely refrain from vaginal examinations or operations, but it is also necessary to shield the vaginal orifice so far as possible from the air by a sterilised dressing. The necessity for the latter step is frequently not recognised even by obstetricians who attach the greatest importance to vaginal asepsis. The reason of its necessity is, however, obvious. If the third stage is properly managed, and the complete emptying of the uterus is obtained, then, even if saprophytic bacteria gain entrance to the vagina, it is not a matter of any great importance, as the only pabulum on which they can feed is the lochia, and, as this is always flowing downwards from the vagina, bacteria are removed almost as rapidly as they gain admittance. Consequently, obstetricians have, to a certain extent, fallen into the habit of considering that the presence of saprophytes in the vaginal lochia is a matter of very little importance. This view is all very well so long as a case is quite normal and the emptying of the uterus is complete. If, however, the latter is not the case, the presence of saprophytes becomes of importance, and instead of the gradual removal of the placental fragment, or piece of membrane, by an aseptic degenerative process, the retained fragment undergoes decomposition. In many hospitals, it is customary to apply napkins for the first twenty-four hours, and then to leave the vagina uncovered so that the discharge may flow away on to the draw-sheet. This practice is infinitely preferable to the leaving of an unsterilised napkin in contact with the vulva for a long time, and in many cases it may give most satisfactory results. We consider, however, that still better results would be obtained by the use of a constantly changed pad of absorbent wool, either sterilised or impregnated with some antiseptic of sufficient strength to prevent decomposition of the lochia which soaks into it. The genital canal after delivery is to all intents and purposes an open wound, and must be treated accordingly. If a drainage tube is inserted through an opening into the peritoneal cavity, no one would think for a moment of maintaining that because the operation of inserting the tube was carried out aseptically, and the discharge from the cavity was aseptic, that the tube should be allowed to discharge openly on to unclean dressings. The immediate result of such a course would be that the escaped discharge would putrify round the mouth of the tube, and that the putrefactive organisms would extend along the tube and involve any dead matter they came across. That such a course does not more frequently occur in the case of the genital canal is due to the absence of dead matter and the strong downward current of the lochia. The common-sense mode of treating the genital wound—for so it may be termed—consists, first, in interposing some substance between it and the air which will receive the discharge and prevent it temporarily from putrefying, and which will, at the same time, act as a filter through which bacteria cannot pass; and, secondly, in changing this dressing and cleansing the external parts with sufficient frequency.

We have already drawn attention to the necessity for sterilising the pad, which is applied after labour over the vulva, by soaking it in corrosive sublimate solution, and we wish now to insist on the necessity for adopting the same course throughout the puerperium. A dry sterilised pad would be preferable to the wet corrosive pad, but the former is rarely obtainable in general practice, although there is no reason why it should not be obtained in hospital practice. This pad should be covered with a protecting sheet of dry absorbent cotton-wool, which may, if wished, be impregnated by some antiseptic, such as salicylic or boracic acid. During the first twenty-four hours, the dressing should be changed whenever the lochia come through the outer wool, after this it must be changed at least twice, and by preference four times, in the twenty-four hours. At the same time, the vulva and surrounding skin must be gently washed with some weak antiseptic lotion, preferably lysol.

The necessity for vaginal douching during the puerperium is almost as strongly urged by some authorities as it is denied by others. / Galabin[*] considers that 'a course perfectly free from febrile disturbances throughout the puerperal state is more common when regular irrigation is employed.' 2 Dakin[†] admits that, in view of the results of some lying-in hospitals, 'it is obvious that in private practice douches can be safely omitted after normal deliveries,' but still, a little further on, he states that a weak antiseptic douche, though not essential, may with advantage be given once a day if not twice. 3 Giles's attitude is equally guarded. He first states that in 'hospital practice we think the douche should always be given, whilst in private practice it is sometimes better that it should be omitted,' but in another place he states, 'daily douching is not necessary; it is quite sufficient that the outside parts be carefully washed and dried.'* 4 Fothergill† considers douching is 'a cleanly and comfortable practice, and does no harm if the nurse is careful to secure perfect cleanliness.' An entirely opposite opinion is, on the other hand, expressed by others. The authorities of the Rotunda Hospital, where the practice has been given up for years, unhesitatingly condemn the use of a prophylactic post-partum douche, and to Smyly in particular is due the credit of having led to its almost complete condemnation so far as the Dublin School of Midwifery is concerned. 2 Similarly, on the Continent, Schaeffer‡ states that vaginal douches must be avoided after the placenta has been delivered, 3 and Ribemont-Dessaignes§ holds a similar opinion, while, in America, Jewett considers that, if the discharge becomes fœtid, antiseptic douches may be called for. We have already given our own opinion on the subject of prophylactic douching. It is difficult to understand how anyone can be found to still support the practice in view of what is known of the bacteriology of the vagina, of the sources of septic as opposed to saprophytic infection, of the results obtained in the case of tens of thousands of patients where no douching has been performed, and of the admitted difficulty of ensuring that an ordinary nurse will administer a douche in a reasonably safe manner. It is a curious fact that many of those who sanction this practice also allow the douche to be administered with a Higginson's enema syringe, and recommend the use of corrosive sublimate solution — facts, which, we think, show that their opinions are controlled more by a well-rooted conservatism than by scientific principles.

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[*] *Op. cit.*

[†] *Op. cit.*

So far as the doing of harm is concerned, no distinction can be drawn for the first four or five days between a vaginal and a uterine douche, inasmuch as some of the fluid will, in all cases, find its way into the uterus even though the nozzle of the douche is not passed beyond the vagina, and so will carry infection upwards if there is any to be carried. So far as the doing of good, on the other hand, is concerned, there is a difference, inasmuch as, unless the nozzle is carried into the uterus, the current will not be sufficient to wash away putrid lochia or retained clots. Accordingly, in the first four days, in all cases in which a douche is administered, the nozzle of the tube is, perhaps, best passed into the uterus. After that time a distinction may be made, and a vaginal or a vaginal and uterine douche administered as is thought best.

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* 'Encyc. Medica,' *loc cit.*

† 'A Manual of Midwifery,' second edition, p. 459.

‡ 'Obstetrical Diagnosis and Treatment,' American edition, p. 131.

§ 'Précis d'Obstétriques,' p. 549.

Douching during the puerperium is indicated under certain definite conditions:—

(1) If the lochia become fœtid and the condition is not removed within twelve hours by other means.

(2) If the involution of the uterus does not follow its normal course. In these cases a hot douche will stimulate contraction of the uterus and so encourage involution.

(3) If there is secondary post-partum hæmorrhage.

The method of administering a douche and the antiseptics which are suitable have been already mentioned.

Another important factor in the production of involution is rest in the recumbent position. Sub-involution is a much more common occurrence amongst the poorer classes, who return to their work before involution has reached a proper stage, than amongst the well-to-do classes. It is, of course, neither necessary nor advisable that the patient should remain in bed until involution is complete, but she should do so until all lacerations have healed, until the uterus has descended again into the pelvic cavity, and until the lochia have become colourless and have almost or completely ceased. As a general rule, these conditions are fulfilled about the tenth or twelfth day, and, save in exceptional cases, it is not necessary that the patient should remain longer than this in bed. She need not, however, maintain the recumbent position during the entire period. After the third or fourth day, if feeling well, and if the perinæum has not been sutured, she may be propped up in bed by means of a few pillows for a short time, and, after the sixth day, she may similarly sit up in bed without support. In this way the tedium of convalescence will be rendered less, and by the promotion of vaginal drainage involution will be encouraged.

Lactation.—The treatment of the breasts differs according as the mother decides to nurse the infant or not to do so. In cases in which she decides to nurse, the initial preparation of the nipple has been described. As soon as she is rested after the completion of delivery, the infant may be put to the breast, with the object of stimulating lactation, of promoting contraction of the uterus, and of allowing the infant to get the benefit of the colostrum. From this on, until lactation is established, the infant may be put to the breast every four hours. As soon as lactation is established a regular interval of two hours is allowed between each feeding, with the exception of one interval of four to five hours at night. In all cases, the nipples must be washed with a little warm water before and after each nursing. The first washing is performed in order to remove any milk which may have dried on the nipple and which, being sour, would produce a bad effect upon the child. The second washing is performed in order to remove the remains of all milk from the nipple, and so to prevent, as far as possible, milk decomposing there and leading to the infection of the milk glands and ducts.

If the nipples become cracked owing to the tender condition of the skin, the crack may be lightly touched with nitrate of silver or painted twice a day with a little Tinct. Benzoin. Co. If the crack renders the act of nursing painful, a nipple shield may be placed over the nipple and the child allowed to suck through it. A little lanoline rubbed into the base of the nipple each day will render the skin elastic and help to close up any cracks, and for this reason is said to be better than the usual hardening agents, such as alcohol. When all cracks are healed the shield may be dispensed with.

If the breasts become knotted, tense, and tender, considerable relief will be obtained by the application of what is known as a cere-cloth—that is to say, of a piece of lint covered with cere ointment, a preparation consisting of one part of yellow wax and eight parts of olive oil. If the nipples are so depressed that the infant cannot seize them, a nipple shield must be used. If the breasts are swollen and distended and tend to fall unduly to one or other side owing to their weight, a breast bandage so applied as to maintain them in their proper position will give considerable relief. A saline purgative may also be administered. If the amount of milk is insufficient, it may be indirectly increased by 'over-feeding' the mother—that is, by inducing her to take a greater proportion of nourishment than she is actually inclined for or than would be natural under other circumstances. Care must be, however, taken that the digestion is not interfered with. The administration of some of the various milk derivatives—such as somatose and plasmon—may also produce a good effect.

If the mother does not intend to nurse the infant, the necessary steps for preventing the establishment of lactation must be taken as soon after the completion of labour as possible. The first step consists in refraining from any procedure which tends to stimulate the secretion of milk, such as drawing out the nipple or putting the baby to the breast. Then, as soon as the patient is rested, a pad of cotton-wool may be applied over each breast and kept in place by a bandage so applied as to exert gentle elastic pressure upon the breast. It is customary to apply to the breast some application which is reputed to check the secretion of milk, and that usually adopted is glycerine of belladonna (Ext. Belladonnæ, grs. lx.; Glycerinæ, ℥i.) which is painted over the breast. Rubbing is contra-indicated, as it tends to encourage the activity of the gland. A substitute for belladonna is to be found in the cere ointment, to which we have already referred. It is the anti-galactogogue which has been adopted at the Rotunda Hospital for a considerable time, and it is, to our mind, as satisfactory as belladonna and safer for use in general practice. In addition to compression of the breast and the application of an anti-galactogogue, a brisk saline purge should be administered on the morning of the second day or even before this if the patient's condition does not contra-indicate it. The internal administration of iodide of potassium has also been recommended in these cases on account of its action in checking gland secretion. It may be given in doses of twenty grains, if it is required, but this is rarely the case.

If the breasts become very tender and tense, a small quantity of milk, sufficient to diminish the tension, may be drawn off with a breast-pump, but, as this procedure tends to stimulate the activity of the gland, it should not be adopted unless the discomfort of the patient renders it necessary. If belladonna is applied to the breast, the infant should not under any circumstances be allowed to suckle, as the toxic effects of belladonna upon young infants are considerable.

In all cases in which the mother is healthy she should, if possible, nurse the infant. If it is subsequently found that her milk is either insufficient in quantity or unsuitable in quality she may have to stop doing so, but, as it is impossible to foretell this, she should, in all cases, try to nurse. The conditions which render it inadvisable that she should nurse may be divided into two classes. She should not nurse the infant for her own sake, if she is in an enfeebled condition owing to previous hæmorrhages, phthisis, anæmia, or during convalescence from any acute disease. She should not nurse the infant for its sake, if she is suffering from syphilis, if her milk is of poor quality, or if the breasts are inflamed. In cases of phthisis, or during acute fevers, nursing is also contra-indicated for the sake of the infant.

General Points.—There are a few remaining points in the management of the puerperium which do not come under either of the foregoing headings and which we will now briefly refer to.

Sleep.—Plenty of sleep is of the first importance during the puerperium in order that the patient may recover from the mental and physical exhaustion from which she suffers. Nature thoroughly recognises this fact, and it is but rarely indeed that a puerperal woman does not sleep sufficiently, unless there is some condition present which prevents her from doing so. Sleeplessness, in the absence of pain, is a serious symptom, and is most usually caused by septic infection, or by some threatening mental derangement. If the patient does not sleep, every effort must be made to determine the cause, and if the sleeplessness persists, it may be necessary to obtain sleep by the administration of a hypnotic, such as sulphonal or bromidia. The use of opium is contra-indicated, if the patient is nursing, save in very small doses.

After-pains.—The common cause of severe after-pains is, as has been mentioned, the presence of a clot of blood in the uterus, and. consequently, the most satisfactory method of getting rid of the pains consists in expelling the clot. To do this gentle massage and compression of the uterus is usually sufficient, but in some cases a uterine douche may be required. The application of a hot compress over the lower portion of the abdomen may also give relief. If the patient is not nursing and the after-pains are very severe, twenty to thirty minims of Tincture of Opium may be given, while if she is nursing a draught containing ten to twenty grains of chloral hydrate, or if there is much mental excitability half a drachm to one drachm of Tincture of Hyoscyamus may be substituted.

Medical Visits.—The obstetrician should, in all cases, see the patient within eighteen hours of her confinement in order that he may satisfy himself as to the emptying of the bladder, the amount of discharge, and the general manner in which the patient is recovering from the effects of labour. Subsequently, he should visit the patient at least once a day for the first three days, and then every second day until the tenth or twelfth day. If her symptoms are not satisfactory she must be seen every day, or, perhaps, in some cases, even twice a day. At the time of his visit he must note the following points concerning the mother:—The temperature, the pulse-rate, the aspect, the amount of sleep she has had since the last visit, the condition of the bowels and bladder, the height of the uterus, the condition of the breasts and the amount of milk, the nature of the appetite, the character and amount of the lochia. He must also ascertain the following points regarding the infant:—Its appearance, the condition of the bladder and bowels, the nature of its appetite and powers of sucking, and the presence of any abnormalities of development which may have escaped notice at birth, or of any pathological condition which may have occurred since. When we know that the nurse in attendance has been properly trained and that we can rely upon her, it is not necessary to enter into all these points in detail, as the simple question, 'How is the patient?' should be sufficient to elicit from her any symptoms or conditions of importance which she has noticed.

Prognosis.—We can determine whether the patient is progressing favourably or the reverse by the information we obtain on the foregoing points. The most important of these are the condition of the pulse and temperature, the aspect, the amount of sleep, and the character of the lochia, and if they are found to be normal we may safely consider that the course of the puerperium is satisfactory. Complications, for the symptoms of which we must specially watch, are septic infection or saprophytic intoxication, secondary hæmorrhage, mastitis, crural phlegmasiæ and any form of mental derangement. The less serious complications are retention of urine, constipation, cracked nipples, and subinvolution.

PART VI

THE PATHOLOGY OF PREGNANCY

CHAPTER I

THE DISORDERS OF PREGNANCY

Disorders of the Digestive System—Nausea and Vomiting—Constipation—Disorders of the Urinary System—Retention of Urine—Incontinence of Urine and Bladder Irritability.—Disorders of the Vascular System—Hæmorrhoids and Varicose Veins—Anæmia—Hydræmia.—Disorders of the Nervous System—Neuralgia—Insomnia—Longings.

UNDER the heading 'the disorders of pregnancy,' we propose to include such temporary systemic disturbances of slight degree as may arise during pregnancy as a result of the altered nutrition, the nervous exaltation, and the anatomical changes by which this condition is accompanied. These disorders may be conveniently arranged in groups according as they affect the digestive organs, the urinary organs, the vascular system, or the nervous system.

DISORDERS OF THE DIGESTIVE SYSTEM

NAUSEA AND VOMITING.—The occurrence of nausea and vomiting during the early months of pregnancy is of such common occurrence that it has been already referred to as one of the subjective symptoms of pregnancy, and may be considered to be physiological so long as it is slight in degree and limited to one period of the day. The older writers, indeed, considered it to be not only physiological, but even advantageous to the pregnant woman, and one of them states that when 'vomiting is entirely absent, utero-gestation does not proceed with its usual regularity and activity' (Ramsbotham*), an opinion which was shared by others. As the nausea usually comes on when the woman commences to move from the recumbent position in the morning, and either before or shortly after leaving her bed, it is usually known as morning sickness. This condition must be carefully distinguished from one in which vomiting occurs after taking food, and is so persistent as to interfere with the nutrition of the patient. The latter condition is a serious one and will be referred to later under the head of 'Hyperemesis.'

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* 'Practical Observations on Midwifery,' part ii., p. 366.

Ætiology.—The causation of morning sickness is obscure Rheinstädter* advanced the hypothesis that it is due to th movements of an enlarged uterus amongst the intestines, bu inasmuch as it occurs at a period when uterine enlargement i little marked, and as it passes off when the enlargement migh reasonably be expected to produce some intestinal compressio or irritation, this explanation seems hardly probable. A mor probable explanation is, perhaps, to be found in considering th phenomenon to be due to the unstable condition of the nerv centres in pregnancy, as a result of which they respond to stimul which, under other circumstances, would not affect them. Th fact that the sickness most usually occurs in the morning can b explained by the change in the position of the patient at tha time and by the fact that 'the nerves are, as it were, then firs roused from their slumber and are alive to impressions whic produce no effect during sleep; hence the irritation of th stomach, like the irritation of the bladder, is felt as soon as th patient wakes from sleep' (Murphy†).

Symptoms.—Morning sickness most usually commences abou the sixth week and passes off about the end of the second mont Occasionally, it may commence earlier or persist until the en of the fourth month. The nausea commonly starts as soon a the woman commences to move from a recumbent position, o perhaps, after she has left her bed. In some cases there may b only nausea, but, as a rule, vomiting follows, after which th woman feels considerably relieved and is well for the remainde of the day. The vomited matter consists of mucus, sometime very acid in reaction, and at other times neutral.

In cases in which the sickness is more marked, nausea an occasional attacks of vomiting may persist for several hours, afte which the patient obtains relief. Such cases are, however, on th borderland of hyperemesis, and must be carefully watched an treated, as, if neglected, the border-line may be passed.

Treatment.—Simple morning sickness requires little or n treatment. Indeed, in many cases, the patient is ill and we again before any treatment can be carried out. As the empt condition of the stomach, perhaps, aggravates the sickness th most sensible line of treatment consists in the patient takin a small cup of tea and a piece of dry toast, or a cup of bread an milk, before sitting up in bed in the morning. This, in associ tion with the regulation of the bowels, usually is all that i required. If the sickness persists after the patient rises, th administration of hydrocyanic acid, of bismuth, of bicarbonate soda, or of any of the ordinary anti-emetic drugs, may be trie A large draught of hot water, which if brought back will was out the stomach, is also useful. In such cases it is well for th woman to remain in bed until the tendency to sickness has passe off, as the active movement of dressing, etc., aggravates the condition.

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* Zweifel's 'Lehrbuch der Geburtshülfe,' 1887, p. 269.

† 'Principles and Practice of Midwifery,' second edition, p. 51.

CONSTIPATION.—Constipation is of very common occurrence in pregnancy, and if allowed to persist may lead to far-reaching ill results to both mother and fœtus. The importance of the regular action of the bowels is considerable at all times, but during pregnancy it is even more marked, as the waste products of both the mother and fœtus have to be then eliminated through the maternal system, and as the proper functionating of the other eliminatory organs is dependent to a considerable extent upon that of the bowels.

Two subsidiary conditions are often found in association with constipation, and may give rise to considerable discomfort; these are pyrosis or heart-burn, and flatulence. Pyrosis is the result of imperfect digestion of food, and though not actually caused by constipation is considerably aggravated by this condition. Flatulence is usually due to abnormal decomposition of food in the intestines, a process which is necessarily promoted by constipation.

Treatment.—If possible, we should always endeavour to relieve constipation by alterations in the patient's dietary and general mode of life, rather than by the administration of drugs. If, however, it is found to be impossible to regulate the bowels by such means, laxatives must be resorted to or the use of enemata, and as a last resource purgatives must be administered. It is best to avoid the use of the latter during pregnancy if possible, but if the necessary movements of the bowels cannot be obtained by other means, their use is indicated, as on no account must a condition of constipation be allowed to persist. The dietetic treatment of constipation consists in the main in the use of such foods as leave in the intestine a considerable amount of undigested residue which, by its presence, causes a mechanical irritation of the intestinal mucous membrane. Such foods are green vegetables, whole-meal bread, stewed dry fruits or ripe fruits, salads, and fresh fruit jams and preserves. A common cause of constipation during pregnancy is an insufficient consumption of fluids, leading to a diminution in the fluid part of the intestinal secretions and a consequent dryness of the intestinal contents. In order to counteract this the free consumption of fluids, especially water, is advisable. In many cases of constipation great benefit is derived from good draughts of water before going to bed and in the morning while still fasting. Similarly, plenty of fluid may be consumed through the day, provided that it is not taken in such a manner as to interfere with the appetite.

If laxatives are required, perhaps the best form in which to administer them is as some of the natural saline mineral waters, such as Apenta, or Hunyadi Janos water. Either of these may be given as a routine every morning on an empty stomach in quantities of half a wineglass to two wineglasses. If their use is not sufficient, a water or a soap and water enema may be given, when necessary, in the case of patients who are not upset by it—as some are prone to be. Other laxatives which may be found of value in particular cases are Tamar Indien, small doses of Castor Oil (ʒi. to ʒiii.), Sulphate of Magnesium (ʒ½ to ʒi.), Cascara Sagrada (ʒss. of the Liquid Extract), Calomel (gr. ss. to gr. i. repeated), or compound liquorice powder (ʒss.). 3 If such doses are not sufficient, the drugs must be given in purgative doses. 4 The best method of relieving pyrosis is by promoting digestion, by giving suitable and easily digested food, and by the use of carminatives. If the gastric secretions do not appear to be capable of discharging their function, it may be necessary to administer adjuvants, such as one of the many preparations of pepsine, or, in rare cases, to feed the patient on partially pre-digested foods. 5 Excessive flatulence will be best relieved by the administration of creosote and by avoiding all foods which tend to promote fermentation. As foods which leave a large undigested residue tend to promote fermentation it will usually be impossible to carry out the dietetic treatment of constipation by their aid in cases in which the patient suffers much from either pyrosis or flatulence, and, consequently, other means must be adopted. As an alternative to creosote, Dakin recommends the administration of sulpho-carbolate of soda from three-quarters of an hour to one hour after meals. A small dose of a pepsin preparation, taken during meals, is also of use.

3 SALIVATION.—Profuse salivation, or ptyalism, is a rare concomitant of pregnancy. In some cases, very large quantities of thin saliva are secreted, as much as a quart, or even more, coming away in the twenty-four hours. It is a most distressing condition as, in bad cases, it necessitates the patient continually catching the saliva as it dribbles from the mouth. Occasionally, there is an accompanying swollen and painful condition of the sub-maxillary and parotid glands.

Treatment.—Probably the only drug which will be found to produce any effect is atropine. It may be given in two to four minim doses of the Liquor. It is also recommended to wash out the mouth with astringent gargles, but it is difficult to see how such a process can affect the condition. The administration of potassium bromide has been tried with success (Dakin*).

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* *Op. cit.*, p. 286.

DISORDERS OF THE URINARY SYSTEM

The various forms of renal disease which may be met with ring pregnancy are of too great importance to be treated of in e present chapter, and, consequently, we shall here only refer to ch conditions of the bladder as may be the temporary results of regnancy and may give rise to interference with the normal nctions of this viscus.

Retention of Urine.—Retention of urine is a serious, but ncommon occurrence during pregnancy.

Etiology.—It is practically confined to cases in which a dislacement of either the uterus or vagina brings about a mechanical nterference with the normal relations of the neck of the bladder d urethra. The two most common conditions which act in this nner are retro-deviation of the uterus and prolapse of the uterus r of the anterior vaginal wall. As each of these conditions will e subsequently referred to, it is unnecessary here to say more egarding the manner in which they cause retention, than that etention is caused, in retro-deviation of the uterus, by direct comression of the neck of the bladder between the enlarged uterus nd the back of the symphysis, and, in prolapse of either the terus or the vagina, by the displacement downward of the bladder leading to kinking of the urethra.

Symptoms.—The first symptoms caused by retention are too well known to need mention; when, however, the bladder becomes much over-distended the symptoms alter, and so sometimes give rise to confusion. Such a degree of over-distension can only occur in cases in which the bladder has become an abdominal organ, as is the case in retention due to retro-deviation of the uterus. In these cases, the most urgent symptom of the patient is intense pain, referred not only to the bladder, but to the pelvis generally. The pelvic pain is due to the pressure of the enlarged uterus, and serves to some extent to mask the nature of the case. The initial desire to empty the bladder may completely pass away, and be replaced by the fancy that there is no water in the bladder. This notion is, to a great extent, due to the fact that the urine dribbles away involuntarily from the over-distended bladder and that, consequently, the patient considers that 'she is emptying the bladder every few minutes.' To this condition of incontinence, due to over-distension, the term *ischuria paradoxa* has been applied.

Diagnosis.—The diagnosis of distension of the bladder can be made by palpating the distended bladder in a case of considerable distension, or, in a case of slighter distension, by mapping out the outline of the bladder by percussion. An over-distended bladder must be distinguished from an enlarged uterus or other tumour. This can be done from the history of the case and from the results of a bi-manual or vaginal examination. In retention due to uterine prolapse, the distended bladder will be found in the pelvic cavity. These cases do not, however, give rise to considerable degrees of distension, as, in all probability, as the bladder fills it rises in the pelvis sufficiently to straighten out the kinked urethra.

Treatment.—In cases due to prolapse, there is usually no difficulty in passing a catheter and drawing off the urine. The prolapse must then be suitably treated in order to prevent a return of the retention. In cases of retention, due to retro-deviation of the uterus, it is often most difficult to empty the bladder. The causes of this are to be found in the upward displacement of the orifice of the urethra, which is brought about by the mal-position of the uterus, and which may render it difficult or impossible to pass a catheter into the orifice; in the compression of the urethra by the enlarged uterus; and, even after the catheter has reached the interior of the bladder, in the blockage of its eye by detached pieces of vesical mucous membrane. If the ordinary metal female catheter cannot be passed in these cases, a male gum-elastic catheter must be tried, and it will sometimes be possible to pass this when the other has failed. Barnes* recommends that 'the point of the catheter, instead of being directed a little backwards under the pubic arch, be directed close up behind the symphysis.... It should, in the first instance, be passed in as far as it will go, and then, when the urine ceases to flow, withdrawn by slow degrees, when more urine will often flow as if the catheter tapped fresh pouches of the bladder.' If the attempt at introduction proves unsuccessful, the patient must be placed in the knee-chest position and an attempt again made with a gum-elastic catheter. Sometimes, it may be possible to lessen the pressure upon the urethra by introducing a finger into the vagina and pressing the cervix backwards. If even this attempt fails, there is usually nothing for it but to puncture the bladder supra-pubically and to draw off the urine. In such cases, the needle of the aspirator is introduced about two inches above the symphysis in the middle line.

INCONTINENCE OF URINE AND BLADDER IRRITABILITY.—Slight incontinence of urine, leading to the escape of water during the act of coughing or straining, is not an infrequent condition, especially amongst multiparæ. Irritability of the bladder is also a common condition, especially in the early months.

Causes.—Incontinence during pregnancy is caused by a relaxed condition of the sphincter, due, perhaps, to stretching and compression of the neck of the bladder during a previous pregnancy, *plus* the increased intra-abdominal pressure, which is the result of the enlarged uterus. Irritability of the bladder is the result of the increased pressure to which the latter is subject, and is most marked when the uterus is a pelvic organ—*i.e.*, up to the end of the fourth or fifth month. After this time, the uterus rises into the abdomen, and almost all its weight is taken by the abdominal walls and iliac bones; consequently, there is at once more room for the bladder to expand, and less pressure upon it.

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* 'Obstetric Operations,' third edition, p. 273.

Treatment.—Little can be done for the relief of incontinence during pregnancy. If it occurs, the patient must be warned of the importance of keeping the parts as dry and free from urine as possible, as otherwise an unpleasant erythema results. An ointment rubbed on the parts will prevent the urine from coming into contact with them. Irritability may be alleviated by the administration of Tincture of Hyoscyamus, and at the same time the patient ought to be advised to refrain from drinking excessive quantities of fluid, particularly such forms as she finds by experience have a diuretic effect. In irritability occurring during the first half of pregnancy, it is usually safe to promise that the condition will pass off in a little time.

DISORDERS OF THE VASCULAR SYSTEM.

HÆMORRHOIDS.—Hæmorrhoids and varicose veins are very constant occurrences during pregnancy. As a rule they are slight in degree, and pass off with the other temporary effects of pregnancy. In some cases, on the other hand, they are severe in degree, and persist permanently.

Causes.—The frequency with which hæmorrhoids occur during pregnancy is due to the increased resistance to venous return through the pelvis, caused by the presence of the enlarged uterus, and also to the increased quantity of blood which goes to the pelvis during pregnancy. Varicosities of the vulvar and vaginal veins and of the veins of the leg are also of common occurrence, and are due to the former cause. As a rule, the varicosities which occur on the legs are capillary, and are formed by a network of tiny dilated vessels. The veins of the left side are most affected, in consequence of the relation of the rectum to the intra-pelvic veins.

Symptoms.—The symptoms caused by hæmorrhoids are often most distressing, particularly towards the end of pregnancy. The common capillary varicosities of the veins of the leg do not as a rule give rise to any inconvenience, but if the larger veins are involved they may give rise to so much pain and œdema of the leg as to render walking or standing most painful, and even rupture of, or thrombosis in, a vein may result.

Treatment.—The prophylactic treatment of hæmorrhoids consists in the regulation of the bowels and in avoiding all long standing or excessive exercise. If they occur, palliative treatment is all that can be adopted or is necessary, save in the most exceptional cases. The motions must be kept soft and regular, and after the emptying of the rectum a suppository containing extract of witch hazel may be introduced into the bowel, or a small quantity of the extract itself, diluted with an equal quantity of water, may be injected with a small rectal syringe. If the hæmorrhoids are prolapsed, they should be replaced and kept up if possible. If this cannot be done, or if the hæmorrhoids are external, bathing with water containing a small quantity of laudanum may give relief. If the hæmorrhoids are inflamed, a hot compress or the old-fashioned bread-poultice is most soothing. In addition, the parts round the rectum and the hæmorrhoids themselves should be bathed several times during the day with warm water, to which a little extract of witch hazel has been added. In very rare cases, if the pain caused by the condition is so great as to interfere with the patient's sleep and health, or if continued bleeding is occurring, and relief cannot be obtained by means of palliative measures, it may be necessary to adopt radical measures and to ligature or remove the hæmorrhoids. Such cases are, however, very rare, as in almost all instances, even if the hæmorrhoids are very severe, radical measures can be postponed until after delivery.

Varicosities of the vulvar veins do not as a rule call for any special treatment. If they are associated with œdema of the parts, relief may be afforded by wearing a soft support applied in the manner of a diaper. If this is not sufficient, it may be necessary for the patient to remain in bed in a recumbent position.

Varicosities of the veins of the leg, if confined to capillary vessels, do not call for any special treatment beyond the avoidance of prolonged standing or exercise and the regulation of the bowels. If the larger veins become involved, an elastic stocking or bandage may be worn. Only in rare cases, where rupture is threatening, is a radical operation indicated during pregnancy, as even the severest cases will be temporarily alleviated by rest in bed.

? ANÆMIA.—Under normal cirumstances, the number of red blood corpuscles in the body is increased during pregnancy, but sometimes, owing to mal-nutrition, unhealthy surroundings, insufficient food, or the like, the opposite condition may occur, and the patient become anæmic. This condition exercises a prejudicial effect upon the heart and the other general functions of the body, but is usually amenable to treatment. On the other hand, it may sometimes pass into a condition of progressive pernicious anæmia, the prognosis of which is extremely bad.

Treatment.—The treatment of simple anæmia consists in the regulation of the bowels, the removal of all factors which tend to cause or to perpetuate the condition, and the administration of iron and, perhaps, small doses of arsenic. Plenty of good and easily digested food, fresh air, and moderate exercise are also necessary adjuncts. Iron is most usually administered in the orm of the carbonate, as in Blaud's pill; it may also be given in ombination with aloes, as in the Pil. Aloes et Ferri of the Pharmaopœia; or as Ferrum Redactum, a form which was particularly ecommended by Lusk.

HYDRÆMIA.—A certain degree of hydræmia, or increase in the mount and the proportion of the watery elements of the blood, s the rule in pregnancy. If, however, the physiological degree is exceeded, various unpleasant symptoms may follow. Such a condition is usually associated with anæmia, and leads to œdema of the lower extremities and of the vulva, as well as in occasional cases to the occurrence of serous effusions in the thoracic, peritoneal, and pericardial cavities. Occasionally, the œdema of the vulva may reach such an extent that the labia become enormously swollen, reaching even to the size of a fœtal head, and in such cases the pressure upon the skin of the labium may be so great as to cause its rupture or sloughing, or even gangrene of the part may result from interference with the blood-supply.

A slight degree of hydræmia is not of any great clinical importance, save in that it may be confused with renal disease on account of the accompanying œdema. A diagnosis can be made by a careful qualitative and microscopical examination of the urine. Severe degrees of hydræmia, in which the accompanying œdema is great, are of importance for several reasons. In the first place, the health of the patient suffers in consequence of the inability to take exercise and from the accompanying anæmia. Further, gangrene or rupture of a swollen labium may occur, leading, perhaps, to the establishment of a centre for septic infection closer to the genital tract than is safe. Finally, the enlarged labia and vulva may offer an obstruction to the birth of the fœtus, while the bloodless and water-logged condition of the parts renders them so soft that extensive lacerations may occur. Such lacerations will probably fail to unite, even if sutured.

Treatment.—Proper attention to the hygiene of pregnancy will usually, but not always, avert the occurrence of a pathological degree of hydræmia. Slight œdema requires no special treatment, save the avoidance of too long standing or excessive exercise. If the œdema becomes marked, the patient must rest in the recumbent position, the legs being raised. Distension of the labia may be further treated by the application of lead lotion. The parts should not be punctured, if it is at all possible to avoid doing so, on account of the difficulty of keeping the wound aseptic in the bloodless condition of the tissues. If, however, gangrene threatens, puncture may have to be performed, and in such cases every aseptic precaution must be taken. The administration of iron has not been attended by any great benefit in these cases, save so far as its effect upon the accompanying anæmia is concerned. Hydragogue purgatives are contra-indicated, as they tend to still further impoverish the blood, and so to aggravate the condition (Lusk*). Good feeding and the administration of cod-liver oil and malt extract will be most likely to be of service.

IV DISORDERS OF THE NERVOUS SYSTEM

1 NEURALGIA.—Neuralgic pains, occurring particularly over the trigeminal and facial branches of the fifth nerve, are often met with during pregnancy. They do not possess any special significance, and pass away with the other temporary effects of pregnancy. Toothache and face-ache are the most common forms in which they occur, and mammary and intercostal pains may also occur as the result of the irritation of other nerves.

Treatment.—If any definite cause for the pain can be found, such as carious teeth, it must be removed or alleviated. There is no reason why the extraction of a tooth or the stopping of a cavity should not be performed during pregnancy; indeed, such an operation is very much preferable to the constant interference which pain will cause with the comfort and rest of the patient. In simple neuralgia, local applications of warmth or of camphor or chloroform liniment will sometimes give relief. Small doses of tincture of gelsemium, or of quinine, phenacetine, or hyoscyamus may be given internally. If the pain is very severe, it may be necessary to resort to the use of morphia, or a kindred drug; but if possible its use should be avoided. In addition to the administration of drugs for alleviating pain, the digestion should be carefully attended to and any constipation removed. If the patient is anæmic, iron and arsenic may be administered.

2 INSOMNIA.—Insomnia is not a common occurrence in pregnancy, but in the few cases in which it occurs it has a most prejudicial effect, as a pregnant woman requires the full amount of rest to enable her to make up for the increased tissue waste which goes on, and to give the already over-excited higher centres a period of repose. Nature so completely recognises this necessity, as shown by the rarity of insomnia in pregnancy, that its occurrence must be considered as of serious import, and as pointing perhaps to the onset, or actual presence, of some important nervous derangement. In other words, the occurrence of persistent insomnia during pregnancy must be regarded as both a likely causal agent, and as a symptom, of insanity.

Treatment.—On account of the prejudicial effect of insomnia upon the patient, every effort must be made to induce sleep in those cases in which insomnia occurs. At first, an attempt should be made to do this without the use of drugs. Proper exercise in the open air, a warm bath before retiring, and the removal of all causes which may tend to produce mental excitement, will sometimes be sufficient. Hunger is a common cause of sleeplessness, even though it is not sufficiently marked for the patient to be conscious that she requires food. On this account, a glass of milk or a biscuit before going to bed will frequently be found to help sleep. If such simple measures fail, hypnotics must be administered, as their use is a less evil than continued insomnia. Sulphonal or trional is the best of the many hypnotics at our disposal. If given in a single dose of from ten to twenty grains every second night, they will, as a rule, produce sleep without losing their effect; and, as in many cases where there is no pain, a sleepless night is the result of previous sleepless nights, the obtaining of a natural sleep by means of a hypnotic for a week or so may enable the patient to subsequently sleep without its aid. If sulphonal is found unsuitable or unsuccessful, chloral, bromide of potassium, or bromidia may be tried, and, if they fail, nepenthe or codeine. Opium or morphia should only be used as a last resource.

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* 'Science and Art of Midwifery,' fourth edition, p. 115

LONGINGS.—The so-called longings of pregnancy, or pica, are rarely met with at the present day, and seem, like 'the vapours' and such kindred complaints, to have in great part disappeared, in consequence of the greater number of interests of, and the more active life lead by, women. Lusk* considered that they were in great measure mythical, but when we note the constant references to them by the older writers, both lay and medical, it can scarcely be denied that, whether they occur at the present day or not, they were relatively common in past times—indeed, so common that they were, and still are by many, regarded as a subjective symptom of pregnancy. Longings principally affect the appetite, but also lead to strange perversions of the ideas, inclinations, and antipathies of the patient. Those who desire further information regarding them will find excellent descriptions in Montgomery's† and Parvin's‡ works.

Before leaving the subject of the disorders of pregnancy, we should like to echo Lusk's remarks on their treatment. It is vain to endeavour to treat all the disorders of pregnancy *seriatim*, as by so doing we inevitably rivet the attention of the woman on her condition to an undue extent, and only lead to a fancied aggravation of her discomforts. When these disorders are slight, the best remedy is a proper degree of attention to the hygiene of pregnancy, and the distraction of the patient's mind from their existence by a proper proportion of pleasures and occupations. When, on the other hand, they become severe, and, by interfering to too great an extent with the comfort of the patient, commence to react injuriously upon her health, every effort must be made to cope with and remove them.

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* 'The Science and Art of Midwifery,' fourth edition, p 112.
† 'Signs and Symptoms of Pregnancy.'
‡ 'The Science and Art of Obstetrics.'

CHAPTER II

DISEASES OF THE DECIDUÆ AND OVUM

Decidual Endometritis, Acute, Chronic—Abnormal Permeability of the Membranes—Vesicular Mole—Chorion-Epithelioma or Deciduoma Malignum—Hydramnios—Oligo-hydramnios—Syphilis of the Ovum—Anomalies and Diseases of the Placenta, Anomalies of Position, of Size and Shape, Tumours, Œdema, Tuberculosis, Calcareous Degeneration, Placental Infarction, Placenta of Renal Disease—Anomalies of the Umbilical Cord, of Length, of Development, Abnormal Insertion.

DECIDUAL ENDOMETRITIS

Decidual Endometritis is a most important condition, and is of by no means infrequent occurrence during pregnancy.

Varieties.—Two varieties of decidual endometritis are met with:—Acute decidual endometritis; and chronic decidual endometritis.

Acute Decidual Endometritis.—This rare condition is the local manifestation of different acute infectious diseases. In consequence of the altered blood-pressure, of the presence of toxins in the blood, or more rarely owing to direct infection by bacteria in the blood, inflammatory and hæmorrhagic changes occur in the decidua. In all probability those diseases which are associated with sudden and considerable alteration of temperature are most prone to cause this condition. A typical case occurring as a result of cholera has been described by Slavjanski,* in which the decidua was thickened, dark purple in colour, and full of extravasated blood. Somewhat similar conditions have also been described as occurring in measles (Klotz †). It is probable that in all cases in which the condition occurs, abortion results. Microscopically, these cases are marked by an increase in the number and size of the decidual cells, and by a round-celled infiltration. The latter is sometimes so excessive as almost to entirely hide the decidual cells themselves, and in such cases a layer of pus may cover the surface of the decidua.

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* *Archiv v. Gyn.*, vol. iv., p. 285.

† *Ibid.*, vol. xxix., p. 448.

Chronic Decidual Endometritis.—Chronic decidual endometritis is a condition of comparatively frequent occurrence, and is one of the commonest causes of abortion.

Pathological Anatomy.—As in cases of endometritis in the non-pregnant, decidual endometritis may result in hypertrophy or atrophy of the decidua. The former change is the more common, a fact which is in all probability due to the effect produced by atrophy, as if the atrophy affects the decidua vera and reflexa only, it does not cause any symptoms, and hence is not noticed, whereas if it affects the decidua serotina it in all probability produces abortion before the atrophic changes are sufficiently marked to make them noticeable in the expelled ovum.

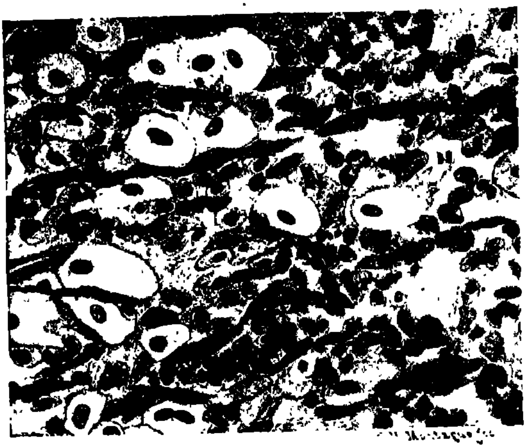

FIG 259.—DECIDUAL ENDOMETRITIS × 280. (Williams)

In the hypertrophic form, there is a general hyperplasia of all the elements of the decidua, which in consistency is softer than normal and contains large vascular spaces. In some cases, the decidua may reach a thickness of half an inch or more, and may closely invest the entire ovum. If any of the enlarged vascular spaces rupture, hæmorrhage occurs into the substance of the decidua and particularly collects between the decidua and the membranes of the ovum. The blood then clots and layers of fibrin are deposited upon the chorionic villi. As a result of this condition, the membranes, instead of presenting a smooth surface towards the fœtus, present a surface covered with hills and hollows, resembling a mass of thrombosed veins (v. Fig. 260). If a section is made through the decidua, the hills are found to be composed of masses of fibrin, outside which lies a greatly thickened decidua, which is also full of extravasated blood.

To this condition the term 'apoplectic ovum' has been applied. Such an alteration in the character of the decidua necessarily interferes with the blood supply of the embryo, and in consequence the latter dies usually during the first two months of pregnancy. It may then be absorbed and disappear, or it may be found as a tiny almost unrecognisable mass hanging at the end of a short and often bladder-like cord. Fothergill describes the histological changes which occur after the death of the fœtus as follows:— 'After the death of the ovum and the stoppage of the chorionic circulation the small fœtal vessels in the villi disappear, the larger ones being more slowly obliterated, leaving for some time a few blood-crystals and amorphous granules to mark their late position.

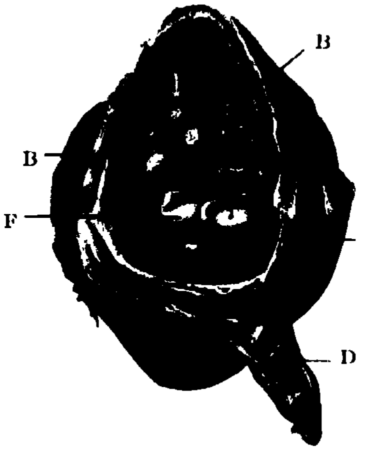

FIG. 260 AN 'APOPLECTIC OVUM.'
F, Fœtus; B, sub-amniotic fibrinous masses; C, chorion; D, decidua.

The fœtal connective tissue between the epithelial layers of the amnion and the chorion, as also that forming the cores of the villi, is compressed, but is not otherwise altered for a long time. The fœtal epithelium lining the amniotic cavity also remains recognisable, but the outlines of its cells are lost and the nuclei become clouded. The fœtal epithelium of the chorion and the chorionic villi undergo similar changes. When this epithelial covering of the villi degenerates after the stoppage of the fœtal circulation, the maternal blood in the intervillous spaces does not long continue to move, but soon forms a firm blood-clot embedding the villi.' If the amount of intra-decidual hæmorrhage is sufficient to effect the detachment of the decidua and ovum from the uterus, abortion occurs. If, however, a slight vascular connection with the uterus still persists, the decidual cells may continue to multiply, the masses of fibrin become organised, the remains of the chorionic villi disappear, and the ovum becomes converted into a mass of tissue resembling the decidua. To this condition, the terms placental or fibrinous polypus, or deciduoma benignum have been applied.

Occasionally, small polypoid or club-like excrescences appear over the surface of the decidua, and bulge into the uterine cavity, and between these elevations, the mouths of the uterine glands can be detected. To this condition the term *endometritis decidua polyposa vel tuberosa* was applied by Virchow.* Another rare form of decidual endometritis is that known as *endometritis decidua cystica*, in which the decidua is studded over by small projections composed of retention cysts due to blocking of the mouth of the uterine glands (*v.* Fig. 261).

When the decidual endometritis gives rise to a profuse watery discharge, the term catarrhal decidual endometritis, or shortly catarrhal endometritis, is applied to it, while to the watery discharge which it causes the term decidual hydrorrhœa is applied. Hydrorrhœa gravidarum is the term applied to any watery discharge which occurs during pregnancy, and from long custom has come to be considered to be a definite pathological condition. This is, however, not a correct manner of regarding it, as it is no more a definite condition than is leucorrhœa. It is a symptom of various pathological conditions, and as its ætiology is now sufficiently established, it is quite time to refer to it as a symptom, and not to consider it separately as if it was a distinct disease. In decidual hydrorrhœa, the decidua is inflamed, the glands being particularly involved, and a watery fluid is secreted by them which accumulates in pouches between the decidua vera and the reflexa. When the amount of fluid in a pouch has become so considerable that there is no further room for its

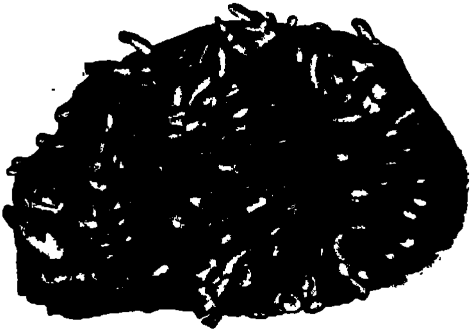

FIG. 261 —ENDOMETRITIS DECIDUA CYSTICA.
(Breus.)

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* *Monats. b. Geburtskunde*, xix., p. 242; and *Die krankhaften Geschwülste*, 1864, ii, pp. 478-481.

storage, it bursts its way downwards and escapes through the uterine orifice. The pathological changes in this condition were carefully noted in a case recorded by Duclos, which occurred in a patient who committed suicide prior to the expulsion of the ovum. The patient was pregnant for about six and a half months, and had had an attack of hydrorrhœa three weeks previously. Between the inner aspect of the uterus and the membranes, there were two pouches situated on the lateral wall and at some little distance from one another. These were filled with a clear fluid of a yellow tinge, and this fluid, as well as that which had previously been expelled, was evidently derived from the uterine glands. In another place, there was an empty pouch, which was apparently that from which the hydrorrhœa had come in the first instance. Fig. 261 shows a case of so-called endometritis decidua cystica, in which a collection of small cysts project from the surface of the decidua in consequence of the blockage of the ducts of secreting glands. Such a condition is probably the preliminary stage in the formation of pouches.

Ætiology.—The cause of chronic decidual endometritis is in most cases a pre-existing endometritis, that is to say, a fertilised ovum becomes implanted upon a diseased endometrium, which in turn forms a diseased decidua. In all probability, decidual endometritis may also result from an undue congestion of the uterus during pregnancy, even when the endometrium was previously healthy. Backward displacements of the uterus are particularly prone to give rise to such congestion, and as is well known, they are frequently the prime cause of abortion. During the process of replacing a retro-deviated uterus, we can frequently notice the flaccid and soft condition of the uterus before reposition and the sudden increase in firmness which occurs when the uterus is replaced. This change, in the case of a pregnant uterus, is undoubtedly in part due to a temporary contraction of the fibres brought about by the stimulus of reposition, but also it is in great part permanent, and shows that prior to reposition the uterus was in an unduly soft condition, and so was receiving a greater blood supply, and holding more blood in its vessels, than it would have done if the muscle fibre possessed a normal tone.

Syphilis and renal diseases are also in all probability common causes of decidual endometritis, and particularly affect the decidua serotina. On this account, the changes which they produce will be referred to later when discussing placental lesions.

Symptoms.—Decidual endometritis may cause slight recurrent hæmorrhages, the death and expulsion of the ovum, or hydrorrhœa. In the last case, the accumulation of fluid may commence at any time after the decidua vera and decidua reflexa have come into contact with one another, and the first escape of fluid may thus occur from the fourth month onwards. At first, half an ounce or so is all that escapes, but as the uterus enlarges, and as, consequently, there is room for a greater accumulation of fluid, the amount which comes away at one time may amount to fourteen ounces or even a pint. If the discharge is large in quantity and escapes frequently, the condition of the patient may be affected prejudicially by it, but ordinarily it produces little or no constitutional effect.

Diagnosis.—Decidual endometritis can only be recognised during the continuance of pregnancy in the cases in which it gives rise to hydrorrhœa. In other cases, its existence is only determined when it has caused abortion, although its presence may be suspected owing to the occurrence of repeated slight attacks of hæmorrhage. The only point in the diagnosis which is of clinical importance is the recognition of the origin of the watery discharge. This may be due to decidual endometritis, or to one of three other conditions:—

(1) Involuntary Escape of Urine.—This can be distinguished from decidual hydrorrhœa by examining the patient as soon after the flow has come away as possible. If the flow has come from the uterus, the vagina will be moist. Further, if any of the escaped fluid can be obtained, it will be found to be neutral or alkaline in the case of hydrorrhœa, and usually acid in the case of urine.

(2) Rupture of the Membranes.—This naturally only occurs once and is followed by the onset of labour. Moreover, on palpation, the uterine walls will be found contracted down upon the fœtus.

(3) So-called 'Amniotic Hydrorrhœa.'—This is the term applied to the escape of liquor amnii through minute tears in the membranes, or by transudation through the membranes. It is difficult or impossible to distinguish between it and decidual hydrorrhœa, though, according to Pinard, it is possible to do so by the examination of the fluid, as in the case of amniotic hydrorrhœa the fluid contains hairs, débris, and vernix caseosa. If, however, the fluid has transuded through the membranes or passed through minute cracks, it will be so filtered that all such matter will have been excluded. The onset of premature labour is more likely to follow in the case of amniotic hydrorrhœa than in the case of decidual hydrorrhœa, but this fact does not help us in making a diagnosis at the time that it is important to do so—*i.e.*, at the time of the occurrence of the flow.

Treatment.—The treatment of decidual endometritis is in the main prophylactic, inasmuch as once it occurs little can be done while pregnancy continues. If a patient suffers from chronic endometritis, it must be treated and cured by curetting and other means when she is not pregnant. During pregnancy, all that can be done is to remove any cause of congestion which may be present, such as uterine displacements, and possibly to promote a more healthy tone in the uterine fibre, and so to regulate the amount of blood going to the uterus, by the administration of ergot and strychnine. There is considerable difference of opinion as to the advisability and utility of administering ergot during pregnancy in cases in which the patient suffers from slight recurrent hæmorrhages. Many obstetricians are opposed to its use on the ground that any effect it may have on hæmorrhage it produces by inducing uterine contractions, and that such contractions will increase the tendency to premature expulsion of the ovum. Atthill,* on the other hand, considered that the administration of ergot and strychnine in combination exerts a valuable tonic effect upon the uterine muscle, and strongly recommends its use in cases of slight hæmorrhage in the early months. He administered five minim doses of Liquor Strychninæ and fifteen-minim doses of Liquid Extract of Ergot, three times a day, continued for several weeks. We have adopted his suggestion in several cases, with the object of checking recurrent hæmorrhages, with the result that the hæmorrhage ceased and pregnancy continued to full term. Whether such results are to be attributed to the administration of ergot or not, there is no doubt that the drug may be safely given in the doses mentioned, and that it apparently exerts a beneficial influence. Accordingly, we recommend that Atthill's prescription be tried in these cases. The administration of Hydrastis Canadensis has also been recommended on account of its action in causing contraction of the fibres of the blood-vessels without producing any effect upon the uterine muscle. The usual dose of the drug is from fifteen to twenty minims of the Liquid Extract, but we cannot say that we have ever noticed any good effects which were even remotely attributable to its use.

If decidual hydrorrhœa occurs, the patient must be kept in bed for a few days after each escape of fluid, on account of the risk that the sudden flow may lead to the occurrence of uterine contractions. It may be that the administration of ergot and strychnine may be of benefit in these cases by diminishing uterine congestion. Ergot, however, should in no case be given if there is any indication that contractions of the uterus are occurring. In such cases opiates may be given instead.

Prognosis.—It is obviously impossible to say what degree of decidual endometritis is compatible with the continuance of pregnancy, and, in view of the fact that we can so rarely do more than suspect the existence of the condition until the expulsion of the ovum has taken place, this is of no great practical importance so far as treatment is concerned. It is, however, frequently necessary to give a prognosis as to the probable interruption or continuance of pregnancy in cases of hydrorrhœa. In all such cases, the prognosis must be most guarded, as the difficulty of distinguishing between decidual and amniotic hydrorrhœa is so considerable. If we are positive that the case is one of decidual hydrorrhœa, our prognosis may be more favourable, and is based on the amount of fluid which has escaped, and on the number and amount of previous attacks if any have occurred. The prognosis after a single escape of fluid is good, and this is also the case when the amount in succeeding flows progressively diminishes. If, on the contrary, the amount increases each time fluid escapes, the probability of the continuance of labour is not considerable, while, if painful contractions of the uterus once commence, it is most improbable that they will pass off and that pregnancy will continue.

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* 'On the Prevention of Post-partum Hæmorrhage,' *Trans. Roy. Acad. Med in Ireland*, vol. xv., p. 344.

ABNORMAL PERMEABILITY OF THE MEMBRANES

In certain cases, the liquor amnii finds its way in small quantities through the membranes and escapes through the uterine orifice, even though there has been no apparent rupture of the membranes; to this escape of fluid the term *amniotic hydrorrhœa* is applied. This condition is a more common cause of hydrorrhœa than is decidual endometritis; it, however, occurs later in pregnancy, and is rarely met with before the eighth month.

Etiology.—The pathology of this condition is obscure. In some cases, the fluid apparently makes its way through small tears in the membranes, which may perhaps be the result of some degenerative process. In others, the amnion is in great part wanting and transudation of fluid occurs through the chorion. In others, the fluid finds its way through the amnion alone, and collects in a pouch between the membranes, whence it escapes owing to rupture of the chorion. In some cases, where the hydrorrhœa is apparently the result of abnormal permeability of the membranes, the latter may have really ruptured high up, while the uterine orifice is still undilated.

Symptoms.—The symptoms of this condition are identical with those of catarrhal decidual hydrorrhœa, save that if the hydrorrhœa is due to rupture of the membranes, it may come away continuously in little gushes. If the hydrorrhœa is due to the rupture of a pouch between the membranes and the uterine wall, or between the chorion and amnion, the fluid comes away with a rush, as in decidual hydrorrhœa.

Treatment.—There is no treatment for this condition save to do everything to prevent the onset of labour. The patient must be kept at rest in bed for several days, and opiates may be given with the object of checking uterine contractions.

Prognosis.—The probability of the onset of labour is very much greater than it is in decidual hydrorrhœa, and consequently the prognosis must be guarded so far as the probable onset of labour is concerned.

β VESICULAR MOLE

Vesicular mole, myxoma chorii, or hydatidiform mole, is the term applied to a cystic degeneration of the chorionic villi, the result of the proliferation and increased activity of their epithelial coverings. The change usually leads to the death of the fœtus and the premature expulsion of the ovum. The term 'myxoma chorii' (Virchow) originated in the belief that the mole was the result of a myxomatous degeneration of the villi—a belief that is now known to be incorrect, though, no doubt, the degenerated villi sometimes contain an undue amount of mucin.

Frequency.—Vesicular mole is a rare complication. According to Engel, it occurred five times in 4,000 pregnancies, a proportion of 1 in 800. This, is however, probably too high a proportion, as Madame Boivin only met with it once in 20,000 pregnancies. At the Rotunda Hospital, 12 cases occurred amongst 20,000 pregnancies, a proportion of 1 in 1666·6.

Ætiology. — It is now so definitely recognised that vesicular mole is the result of a pathological condition of the chorionic villi, that it is curious to recall that, at one time, and that not so long ago, the condition was considered by many to be sometimes in no way associated with pregnancy. So recently as 1887, a distinguished writer on obstetrical subjects, the late More Madden, vigorously contradicted the statement of Priestley* that 'with our present knowledge it would be as reasonable to expect that a child might be expelled from an unimpregnated uterus as a true vesicular chorion.' More Madden considered 'that cases may also occur in which similar-looking products are found in the uterus, independently of impregnation.'† The various ways in which the occurrence of a vesicular mole was accounted for are so numerous and unimportant that we do not consider it necessary to enumerate them.‡

The cause of the alteration in the villi has not been satisfactorily explained. Vesicular mole occurs more frequently in middle-aged than in young women, and in multiparæ than in primiparæ. Out of thirty-five collected cases, fourteen women were between twenty-five and thirty-five, while twenty-one were above thirty-five (Hirtzmann). There is also an apparent tendency to the recurrence of molar pregnancies in the same woman. In three recorded cases, one patient had eleven moles out of twelve pregnancies (Maier), another, three moles consecutively (Depaul), and a third two moles consecutively (Warmann). Virchow* considered that chronic endometritis had some causal effect on the production of moles, and Winckel agrees with this opinion. It would, however, seem to be more probable that the condition is dependent on some abnormal development of the villi themselves, in view of the fact that in cases of twins one ovum may be affected while the other remains healthy. Spiegelberg† regards it as probable that the cause is to be sought in 'an anomalous development of the allantois.' A syphilitic history can be obtained in some

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* 'The Pathology of Intra-uterine Death,' p. 112.

† *Trans. Roy. Acad. Med. in Irel.*, vol. vi., p. 304.

‡ The following extract from Paré's 'Surgery' is worthy of being reproduced, as showing some of the peculiar ideas of the time:—'The Countess Margaret, daughter of Florent IV., Earl of Holland, and spouse to Count Herman of Heneberg, on Good Friday, in the year of our Lord 1276, and of her age forty-two, brought forth at one birth 365 infants, whereof 182 are said to have been males, as many females, and the odd one an hermaphrodite, who were all baptised, those by the name of John, these by the name of Elizabeth in two brazen vessels by Don William, Suffragan Bishop of Treves.' The occurrence is further testified to by a tablet in the church of Lonsdunen, near Leyden, where the Countess and her 'children' lie buried. It is most probable that the cysts of a mole were considered to be so many ova, and then converted into children by the easy credulity of the times.

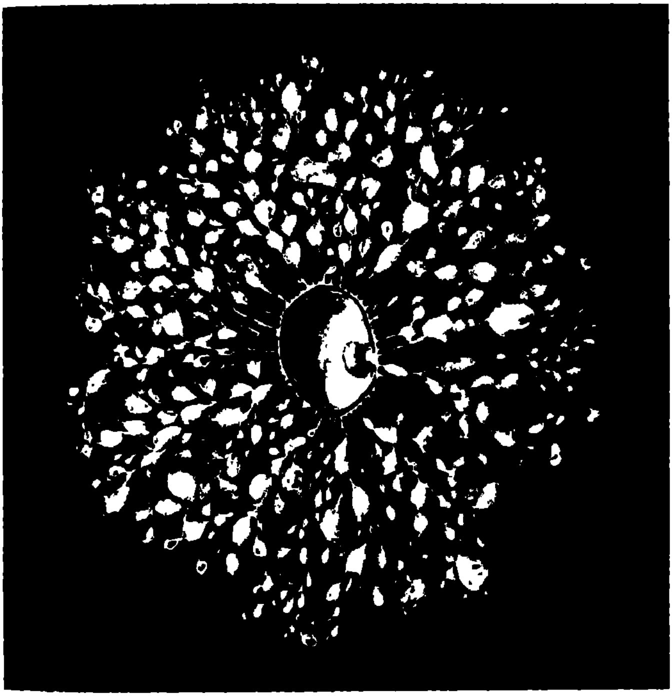

FIG. 262.—DIAGRAM SHOWING THE FORMATION OF A VESICULAR MOLE. (Bumm)

cases, but is not by any means constant. A German writer—Aichel[*]—reported to the 1901 German Gynæcological Congress that he had been able to produce a vesicular mole in dogs by destroying the vessels going to the decidua, and so interfering with the nutrition of the chorionic villi. Further evidence on this point is, however, still required

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* *Die krankhaften Geschwülste*, 1863, i., pp. 405-414.
† *Op. cit.*, vol. i., p. 456

Pathological Anatomy. — The macroscopical appearance of a vesicular mole varies somewhat according to the extent to which it has involved the ovum. If the degeneration is advanced, the entire ovum is involved, and all that remains of the original structure of the latter is destroyed, save that perhaps a small pouch containing fluid may persist as the representative of the amniotic sac. If the degeneration is a stage less advanced, an amniotic cavity of the usual size may be found invested more or less completely by the degenerated chorion, and containing no trace of embryo, save perhaps a little detritus or a fragment of the umbilical cord. In these cases, the fœtus has been absorbed. To this stage, the term 'hollow mole' has been sometimes applied. If the degeneration is only commencing, or has proceeded but a short way, only a portion of the chorionic villi is affected, and the amniotic sac contains a fœtus. If only an inconsiderable portion of the chorion is thus affected, the fœtus may be alive, but, if a large portion is involved, the fœtus will be dead.

The appearance of the mole itself is very characteristic. It is composed of a mass of small cysts, which are formed along the course of numerous pedicles. The pedicle corresponds to the original chorionic villus, while the cyst is the result of the accumulation of fluid at different intervals along its course. This fluid is said to contain salts, albumen, and mucin, and is probably due in great part to œdema of the stroma. When the mole comes away, there is always a certain amount of hæmorrhage, and this, mingled with the fluid which escapes from ruptured cysts, produces a watery blood-stained fluid. The cysts floating in this produce an appearance which is well described by the classical simile of a mass of white currants floating in red currant juice. The cysts vary in size from the size of pins'-heads to that of grapes.

The histological character of vesicular moles has been carefully studied of late by Fraenkel,[†] Marchand,[‡] and Franqué.[§] As will be remembered, the core of the normal villus is composed during the early months of a stroma of mesoblastic tissue resembling the Whartonian jelly, and composed of stellate-shaped myxomatous cells lying in a structureless intercellular substance. In the centre of this core, are found the fœtal capillaries. As pregnancy advances the stroma gradually loses its myxomatous type, and comes more and more to resemble ordinary connective tissue. This core is in turn covered by two layers of cells:—

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[*] 'Ueber die Blasenmole,' etc., *Habilitationsschrift*, Erlangen, 1901

[†] *Arch. f. Gyn.*, 1895, vol. xlix., 481-507.

[‡] *Zeits. f. Geb. und Gyn.*, vol. xxxii., 1895, 405-472; and xxxix., 173-258.

[§] *Ibid.*, vol. xxxiv., 1896

(1) An inner layer termed Langhans' layer, which invests the stroma, and consists of cubical or flattened cells containing a single round or oval nucleus. This layer almost completely disappears after the end of the fifth month.

(2) An outer layer known as the syncytium, and composed of large multinuclear cells or protoplasmic masses. Both this layer and Langhans' layer are derived from fœtal epiblast. The well-defined cell of Langhans' layer is probably the primitive type of cell, and the differences found in the syncytium are probably due to the effect of contact with the maternal blood.*

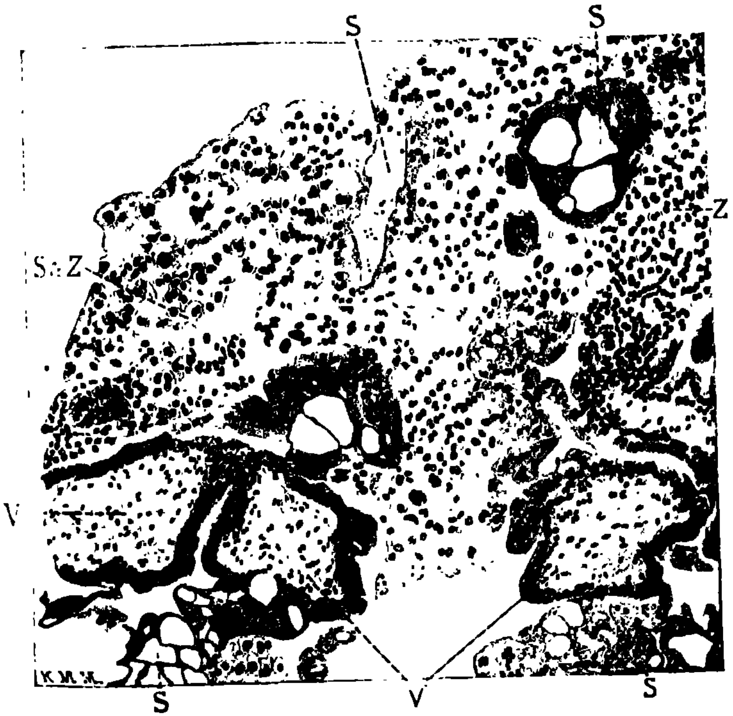

FIG. 263.—SECTION OF HYDATIDIFORM MOLE, SHOWING PROLIFERATION OF SYNCYTIUM AND LANGHANS' CELLS. × 75

S. Syncytium; V, normal chorionic villi. Z, Langhans' cells. (Williams.)

In the vesicles of a mole these three layers persist, but are somewhat altered. The stroma is increased in amount, and degenerated, the fœtal vessels have disappeared, and scattered here and there are cells which are probably offshoots of Langhans' layer and protoplasmic masses from the syncytium. The cells of Langhans' layer proliferate, and form a continuous layer round the periphery of the vesicle. They are in turn covered by the syncytium, which in places shows signs of proliferation. The mole is thus primarily due to the proliferation and increased activity of the cells of Langhans' layer and of the syncytium (*v.* Fig. 263).

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* Teacher, 'Chorion-epithelioma,' *Trans Obstet. Soc. Lond*, vol. xlv., p 261

If the mole does not reach any great size, it may be expelled

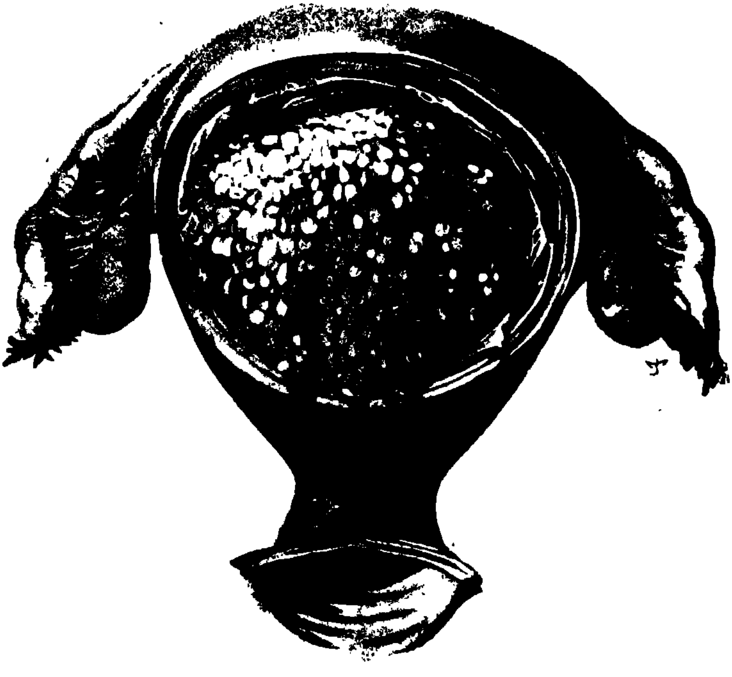

FIG. 264.—UTERUS CONTAINING A VESICULAR MOLE.
(From a specimen in the School of Physic, Trinity College, Dublin.)

while still invested by the decidua, into which the cysts lying most externally penetrate. When the mole has reached a greater size, the decidua may have thinned and in part disappeared, and consequently may remain behind after the expulsion of the mole and be subsequently expelled in small fragments. In rare cases, the mole may grow through the decidua and so gain access to the uterine wall. If it in turn penetrates into the latter, the clinical importance of the case is altogether altered, and we have to do with what to all intents and purposes is a malignant growth. A mole which has grown through its decidual investment, and penetrated the uterine wall, may then in turn grow through the latter and extend outwards into the peritoneal cavity. The relations between this condition and the condition commonly known as deciduoma malignum are apparent, though it is by no means easy to explain their exact nature. They will be more satisfactorily discussed under the head of the latter condition.

Symptoms.—The first symptoms of myxomatous degeneration of the chorion, as a rule, appear during the second or third month, and consist in the occurrence of a watery blood-stained discharge and crampy pains in the abdomen. The origin of the former has been already explained, the latter are due to spasmodic efforts of the uterus to expel the mole. As the prégnancy continues, these symptoms persist and increase in severity, while at the same time the uterus alters in size according as the mole develops. Usually, the uterus in these cases is considerably larger than the period of pregnancy, and occasionally this increase in size is rapid. Tuefferd* records a case in which the uterus rose in fifteen days from the level of the symphysis to the level of the umbilicus—an increase in size which, under normal circumstances, would require two months to occur. Occasionally, the uterus is smaller than it ought to be in correspondence with the period of pregnancy. This occurs when the mole has for some reason ceased to grow, or when a considerable portion of it has been already expelled.

On palpation, the uterus is found in some cases to be more tense than usual, in others to be more boggy and soft. Consequently, so far as its consistency is concerned, we can only say that a skilled examiner will probably be able to detect some variation from the normal. The fœtal parts cannot be felt nor ballottement obtained, save in cases of twin pregnancy, where only one ovum is affected. It is said that the cervix preserves its normal non-impregnated shape and consistency for a longer time in the case of a molar pregnancy than in the case of a normal pregnancy (Legueu), but obviously this is entirely dependent on the period at which the degeneration commences. The fœtal heart cannot be heard save in twin cases as mentioned, and even then it will probably be so masked by the affected ovum that it will be impossible to detect it.

If the uterus is not emptied artificially, it as a rule expels the mole spontaneously at about the end of the fourth month. If expulsion is complete, the patient may then return to her usual condition of health. On the other hand, the hæmorrhages which occur prior to or during its expulsion are sometimes so severe as to bring about the death of the patient, especially if they are associated with a partial emptying of the uterus and decomposition of the remaining portion of mole. In cases of so-called malignant mole, in which the degenerated villi have grown out into the uterine wall, rupture of the uterus may occur during the process of spontaneous expulsion, or during the artificial removal of the mole. If the mole extends through the uterine wall into the peritoneal cavity, the subsequent history will be that of malignant disease of the peritoneum (*v.* Fig. 265).

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* *Union Méd.*, 1873, p. 273.

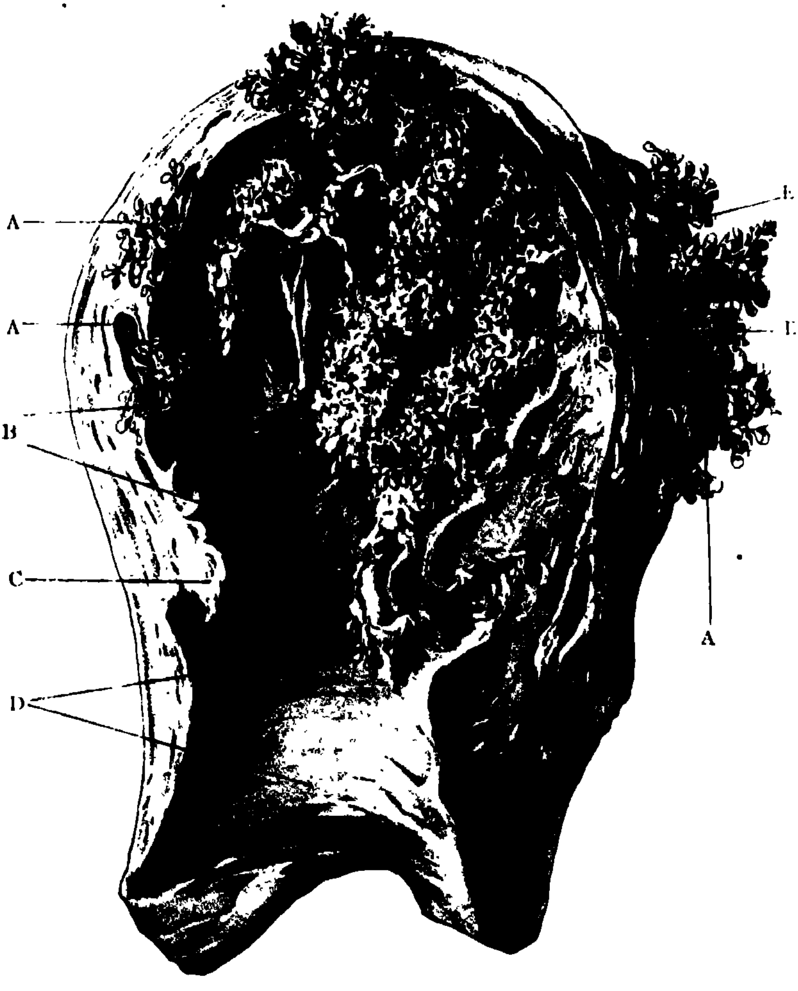

FIG. 265.—MALIGNANT FORM OF VESICULAR MOLE, GROWING THROUGH UTERINE WALL.

A, Uterine sinuses into which the mole has grown; B, sinuses in the decidua serotina; C, os internum; D, cervix; E, growth commencing to invade the uterine wall. (Bumm.)

Diagnosis.—The diagnosis of the case is made from the following points:—

(1) A history of pregnancy, accompanied by many of the subjective and objective signs.

(2) Altered relations between the size of the uterus and the assumed period of pregnancy.

(3) Alterations in the consistency of the uterus.

(4) The peculiar watery nature of the discharge. The presence of small grape-like cysts in it is pathognomonic.

It is, however, by no means easy to arrive at once at a definite diagnosis unless one is fortunate enough to find the characteristic cysts. In many cases, it is necessary to wait and watch the patient from day to day, unless the amount of hæmorrhage which is occurring is excessive, when immediate interference will be necessary whether we are dealing with a vesicular mole or not. It has been suggested that, in doubtful cases, examination with the X rays would clear up the nature of the case by showing the presence or absence of a fœtus (Ouvry*). This may perhaps be found to be the case, but on the other hand the relative opacity of a vesicular mole will probably be found to be as great as that of the embryo or the early fœtus, and, even if there is some difference in the relative opacities, the amount of tissue through which the rays have to pass is so considerable that it would be difficult to detect it.

Treatment.—There is only one line of treatment to be adopted in this condition, and that is to empty the uterus as soon as the existence of a mole is recognised. As it is impossible to foretell whether the uterine wall is infiltrated or not, it is necessary to avoid all manipulations which could cause rupture. For this reason, the practice of removing the mole with the curette must be condemned, on account of the ease with which the curette can perforate a diseased uterine wall. Perhaps, the best practice to follow consists in dilating the cervix with Hegar's dilators, as far as can be done without lacerating it, *i.e.*, up to about No. 16 or No. 20, and then in introducing the largest sized hydrostatic dilator which can be got through the canal. This is allowed to remain *in situ* until it is expelled by the uterine contractions, or if the contractions do not occur within twelve hours after the insertion of the dilator, the latter is gently pulled through the cervix by continuous traction applied to it, as will be described in another place. In most cases, this procedure will induce labour, and the contractions of the uterus will then expel the mole. If they do not do so, the finger or the hand—according to the size which the uterus has attained—is passed into the uterus, and the mole is gently detached from the uterine wall and removed in a manner very similar to that adopted in the case of a retained adherent placenta. After it has been removed, the uterus is douched out with hot water, and firmly tamponned with iodoform gauze. The introduction of the latter is especially advisable in these cases not only with the object of checking hæmorrhage, but in order to bring away completely the numerous small fragments which have been left behind.

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* 'Étude de la Mole Hydatidiforme,' Thése de Paris, 1897.

In some cases, it will be found that a recurrence of the hæmorrhage occurs in from three to six weeks. Such a condition is due to the retention of small portions of the mole, and will only be cured by their removal. As the uterus has by this time become considerably reduced in size, it may with safety be curetted and plugged with iodoform gauze. If possible, the cavity should be again explored with the finger, in order to eliminate the possibility of the malignant form of mole; and if the discharge persists even after the curetting, this step is essential. The reason for this will be more fully appreciated when deciduoma malignum and its connection with vesicular mole has been discussed. If the malignant form of mole is diagnosed, the uterus must be immediately removed. This procedure will perhaps be best carried out by the abdominal route, as the extreme softness of the uterine tissue renders it difficult to draw it down in the manner necessary in vaginal hysterectomy.

Prognosis.—Vesicular mole, if recognised in time and removed with proper aseptic precautions, need not be regarded as a very dangerous condition. On the other hand, its dangers, if allowed to remain, are considerable. The patient may succumb to the continued loss of blood, or she may be so weakened by it that she is unable to stand the emptying of the uterus, and the additional loss of blood which of necessity accompanies this procedure. Further, her condition predisposes to the occurrence of septic infection. If the mole perforates the uterus, death may result from peritonitis or from its subsequent malignant growth in the abdominal cavity. The various minor diseases which accompany pregnancy, are said to be sometimes aggravated in the case of a mole, especially vomiting and pregnancy kidney, and their presence of necessity renders the condition of the patient more serious.

CHORION-EPITHELIOMA OR DECIDUOMA MALIGNUM

The condition, which we are now about to describe, is one which, so far as its ætiology and histogenesis are concerned, was up to the last few years most obscure. As we shall presently see, a large number of theories were brought forward to account for its development, and according as one or other was adopted a different name was given to it. Unfortunately, each of these names implies a particular ætiology, and, consequently, is more or less meaningless unless we at the same time adopt such an ætiology. The result of this was that for a long time there was no term for the condition which could be logically accepted by all observers. The term chorion-epithelioma may, however, now be finally adopted, and although long use may give some sanction to the use of the term deciduoma malignum, so far as this implies that the new growth arises from the decidua it is a complete misnomer.

By the terms chorion-epithelioma and deciduoma malignum, we mean a new growth which is met with in the uterus as a result of pregnancy, which rapidly involves the greater part of or the entire uterus, which causes metastases in other organs, and which almost always rapidly brings about the death of the patient.

Histogenesis.[*]—Speaking generally, the different schools of opinion regarding the origin of this interesting growth may be divided into two groups:—first, those which consider that the growth is directly due to a pre-existing pregnancy; and, secondly, those which consider the growth to be a pre-existing sarcoma of the uterus. If the second opinion is the correct one, the histogenesis of the growth calls for no special attention; if, on the contrary, the first opinion is the correct one, puzzling problems offer themselves for solution.

If the growth is the direct result of pregnancy, it is possible that it should arise from the decidua; from the epithelial coverings of the chorionic villi; or from the stroma of the chorionic villi.

Origin from the Decidua.—Sänger,[†] who was the first to describe the growth, considered that it originated in the decidua, and consequently applied the term 'deciduoma malignum' to it. Subsequently, as a result of an opinion that it originated in the cellular layer of the decidua he altered this term to *sarcoma deciduo-cellulare*, on account of the similarity of structure between the cells of the growth in the case he described and those of the cellular layer of the decidua, the only difference as he considered being that in the pathological growth the nuclei were larger and the protoplasmic ring narrower.

Of late, in consequence of the examination of further specimens, Sänger has agreed to accept the explanation of Marchand, to which we shall next refer, but with the reservation that the possibility of the formation of sarcoma cells out of decidual cells cannot be excluded in view of his first case, which does not correspond in all points with those described by Marchand.

Origin from the Epithelial Coverings of the Chorionic Villi.—Under this heading are included several radically different views arising out of the uncertainty as to the origin of these epithelial layers, and more particularly of the outer layer or syncytium. Now that the discovery of the Peters' ovum has in great part cleared up the origin of these layers, all but one of these views disappear. Still, as they are of historical interest they may be shortly described:—

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[*] The following short résumé of the histogenesis of chorion-epithelioma is largely drawn from papers by Haultain, *Brit. Gynæcol. Journ.*, August, 1899; Smyly, *Trans. Roy. Acad. Med., Ireland*, 1900; and Whitridge Williams, *Johns Hopkins Hospital Reports*, vol. iv., 1893; and from 'Ueber das maligne Chorionepitheliom,' by W. Rissel, Leipzig, 1903.

[†] *Centralb. f. Gyn.*, 1889, p. 132; *Archiv f. Gyn.*, vol. xliv., 1893, p. 89.

(1) That the growth is derived from the syncytium alone, and that the latter is a maternal structure formed from the uterine endometrium. This theory was first adopted by Whitridge Williams,[*] and was really a modification of that originally put forward by Sänger, and indeed Williams was at the time disposed to accept Sänger's theory as accounting for the histogenesis of certain cases. He has, however, now also accepted Marchand's view.[†]

(2) That the growth is derived from the syncytium alone, and that the latter is a fœtal structure formed from the ectodermic layer. This theory was adopted by several authorities and notably by Fraenkel[‡] and Durante,[§] and on this account the term 'syncytial,' or 'ectodermic epithelioma,' has been applied to the growth. Fraenkel has, however, also come to regard Marchand's view as correct.

(3) That the growth is derived from both the syncytium and Langhans' layer, and that the syncytium is a maternal structure. This theory was held by Gebhard,[||] who, in consequence, considered the growth to be a mixed carcinoma of maternal and fœtal structure. It does not appear to have had many other supporters, as the majority of those who consider the growth to be derived from both epithelial layers also adopted, and correctly, as we now know, the fœtal origin of these layers.

(4) That the growth is derived from both epithelial layers and that both are of fœtal origin. This view was introduced by Marchand[¶] in the face of considerable opposition, and was supported by Haultain,[**] and in turn by Williams. It was at first strongly opposed by the London school headed by Eden, but is now almost universally accepted.

Origin from the Stroma of the Chorionic Villi.—This view was brought forward by Gottschalk,[††] who consequently termed the growth a chorio-sarcoma. It received little or no support, and Gottschalk has now accepted Marchand's view.

The view that the growth is a pre-existing sarcoma of the uterus was, and is still, strongly supported by Veit.[‡‡] He admits that the sarcoma is modified by the existence of pregnancy, but states as a general law that disease of the mother is always primary and cannot arise from the fœtus. He admits that no case has been recorded of the implantation of an ovum on a carcinomatous endometrium, but considers that in nodular sarcoma the endometrium resembles that in a myomatous uterus, and that as pregnancy may occur in the one, it may occur in the other. He considers further that it is impossible to regard all protoplasmic masses as true syncitium derived from the outer layer of the villi, and thinks it more probable that in normal pregnancy other cells, such as the epithelium of the endometrium, often take on a syncitial form, and that in consequence it is impossible to regard the syncitium—using the term in this wider sense—as a distinct tissue, but rather as a stage in the development of certain cells. Accordingly, he thinks, a sarcoma may, under the influence of pregnancy, come to resemble the syncitium, and that th[illegible]e the disease should be regarded as a process by which, under the influence of pregnancy, certain cells take on a syncitial character. This view was for a considerable time shared more or less completely by many British obstetricians and pathologists.

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[*] *Op. cit.* [†] 'Obstetrics,' p. 491. New York, Appleton and Co., 1903.

[‡] *Archiv f. Gyn.*, vol. xlix., Hft. iii., 1895.

[§] *Rev. Méd. de la Suisse Romande*, 1896, p. 686.

[||] *Zeitschrift*, vol. xxxvii., p. 480.

[¶] *Monat. f. Geb. u. Gyn.*, 1895, vol. i., p. 513; *Berlin Med. Wochen.*, 1894, p. 813; 1898, p. 11.

[**] *Op. cit.* [††] *Archiv f. Gyn.*, vol. xlvi., p. 1; and *Ibid.*, vol. li., p. 56.

[‡‡] Veit, 'Handbuch der Gyn.,' 1899, iii., pp. 535-596.

We cannot see that Veit's general law regarding the primarily maternal origin of maternal disease need—even if true—necessarily contradict Marchand's view. The invasion of the maternal tissues by an overgrowth of fœtal epiblast may be due to the possession of excessive powers of growth, and special powers of overcoming the resistance of the uterine tissues, or it may be due to lessened resistance on the part of these tissues. In the former case, special powers of growth and of invasion may quite legitimately be conceived to be due to the effect of some irritant acting on the epiblast, and this irritant must of necessity be maternal. In the second case, the diminished resistance is also maternal.

Veit's view was adopted by the Obstetrical Society of London in 1896, and constituted for several years the so-called 'English' view of the origin of chorio-epithelioma. This expression of opinion was, as Teacher says in his now classical paper, a stumbling-block to advances towards the better conception of the pathology of the growth for many years, and cramped the opinion of many who might otherwise have endeavoured to advance our knowledge. So recently as 1901, the author was adversely criticised in a review for giving special notice in another work* to 'deciduoma malignum,' seeing that 'in the majority of cases the growth is simply a large-celled sarcoma, which may or may not be associated with pregnancy.'

As we have already mentioned, Marchand's view is now received by almost every authority of importance with the exception of Veit. It was founded—to quote Teacher—on the anatomical and physiological resemblances between the chorionic epithelium and the tumour tissues, and has been fully supported by a re-investigation of the pathology of vesicular mole, in which it was shown that hypertrophy of the chorionic epithelium is a constant feature. Finally, the finding of the Peters' ovum definitely demonstrated the fœtal origin of the two layers of the chorionic epithelium.

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* 'A Short Practice of Gynæcology.' London, J. and A. Churchill, 1901.

The growing trophoblast, as was long suspected, possesses the power of invading and destroying the maternal tissues up to a certain point, where apparently the resistance of the maternal tissues become sufficient to check this action and an equilibrium is established. In the case of the simple vesicular mole, the epithelial layers proliferate, but their power of maternal invasion is not increased. In the malignant vesicular mole, all the elements of the villi proliferate and invade the uterine wall, the epithelial layer, however, being apparently the active agent of destruction. In the pure chorion-epithelioma, the epithelial layers alone proliferate and invade the uterine wall, and no trace of the mesoblastic core of the villus is found. Between this true chorion-epithelioma and the malignant form of vesicular mole, tumours are found consisting of syncytium and cells of Langhans' layer, through which are scattered a few villi with or without proliferation of their mesoblastic core. These intermediate forms serve to emphasise the close connection between the malignant vesicular mole and the chorion-epithelioma, if indeed they do not render it impossible to draw a hard distinction between them, and also render still more clear the epiblastic origin of the chorion-epithelioma.

Clinically, the connection between vesicular mole and chorion-epithelioma is as close as the investigations of Marchand and Fraenkel into their histological character would lead one to expect. In cases of vesicular mole, one element at least in the production of a chorion-epithelioma is present in the proliferation of the chorionic epithelium, and it is reasonable to suppose that if a lessened maternal resistance to chorionic invasion is also present, a chorion-epithelioma will also result. Haultain has collected the statistics of ninety cases of the latter condition, forty-nine of which followed the expulsion of a vesicular mole.

Pathological Anatomy. — The growth at first appears as a pedunculated or sessile tumour, varying in size between that of a pea and that of an orange. It is attached to the uterine wall and bulges somewhat into the uterine cavity. In consistency, it is friable and easily broken down by the curette; it is grayish in colour and marked here and there over its surface by hæmorrhagic areas. As it grows, it extends into the uterine muscle, and spreads along it in isolated nodules over which the mucous membrane is at first unaltered. Finally, however, the mucous membrane lining a great part of the cavity becomes involved and destroyed. The entire cavity then becomes filled by a fungating mass of placenta-like substance, which breaks down readily under the finger or curette, and bleeds freely. Metastatic growths are the result of emboli carried along in the blood-stream, or of the direct implantation of fragments of the growth into wound-surfaces. They are found most commonly in the lungs and vagina, and also in the broad ligaments, and in the liver, heart, and other viscera.

The histological character of the growth demands some consideration. In many of the recorded cases, differences of structure have been found; still, on the whole, there are certain characteristics which can be found in every or in almost every case. Speaking generally, the growth is found to be composed of blood-clot, two varieties of cellular elements and chorionic villi.

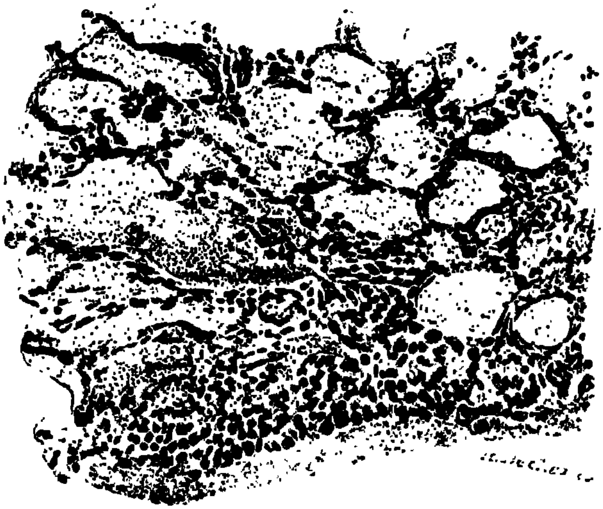

FIG. 266.—CHORION-EPITHELIOMA, SHOWING ALVEOLAR ARRANGEMENT OF PRIMARY TUMOUR. × 60. (Williams.)

Haultain describes the cellular elements as follows:—The cellular elements are of two types:—

(1) Large polyhedral cells, which stain lightly, and whose large nuclei show a wide intra-nuclear network.

(2) Multinucleated deeply-staining protoplasmic masses of all varieties of shape, whose nuclei are extremely rich in chromatin and show no wide intra-nuclear network as in the other cells.

Both varieties of elements show a marked tendency to a retraction of their protoplasm and to vacuolation. Mitotic figures are frequently observed in the individual cells, but nowhere in the protoplasmic masses. The relation of these two types of cells varies greatly; in some cases it appears as if groups of individual cells were confined in alveoli formed by processes of nucleated protoplasm. This is most apparent when in close relation with the chorionic villi. As one proceeds further from the villi, the cells and protoplasmic masses are arranged indefinitely. The individual cells, in some places, are much in excess of the protoplasmic masses, while in others the latter only are to be distinguished. Nowhere is there much evidence of inter-cellular substance or bloodvessels, although free blood is intimately mixed with the cells, and is also found in the vacuoles in their substance. Extending into the muscle can be seen clumps of both type of cells, apparently following the peri-vascular lymph spaces, while, throughout, individual cells may be seen finding their way indiscriminately, with a special tendency to penetrate the venous sinuses and engraft themselves on the interior of their walls, where they continue to proliferate.

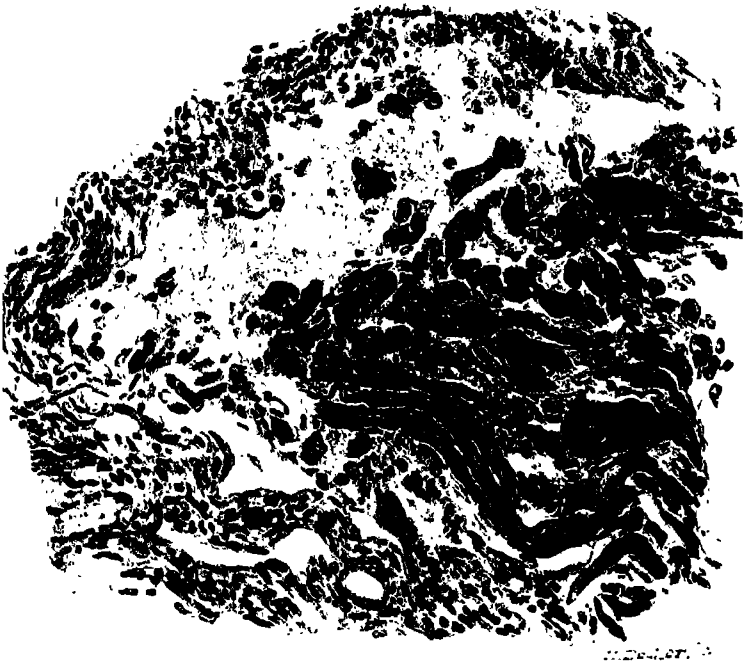

FIG. 267.—CHORION-EPITHELIOMA, SHOWING SYNCYTIAL MASSES INVADING A VENOUS CHANNEL. (Williams.)

On section of the tumour, three areas may be microscopically determined:—

(1) A sub-mucous or peripheral area, which forms the main bulk of the tumour mass, and is necrotic in character, composed of fibrin and cellular elements in all stages of degeneration.

(2) A cellular layer or tumour proper, which is composed entirely of actively proliferating cellular elements and chorionic villi mixed with free uncoagulated blood.

(3) An area of infiltration in which may be seen cells and protoplasmic masses, isolated and in groups, insinuating themselves into the blood channels, and surrounded by the muscle fibres of the uterine wall. In this area, chorionic villi are not found.

The foregoing description, in Haultain's words, is based upon the careful examination of a case with which he met, and agrees in most particulars with the descriptions published by other observers. A third type of cell was also described by Marchand and termed a '*chorion wandering cell.*' It is found as a kind of advance guard in the area of infiltration penetrating amongst the muscle fibre, while the growth proper spreads along in the blood sinuses. The plasmodial masses form the characteristic element of the growth, and can be found in every case.

Symptoms.—The earliest symptoms of chorion-epithelioma consist in a recurrence of irregular hæmorrhages within a few weeks of the occurrence of abortion or the expulsion of a vesicular mole. In a few cases the hæmorrhage has not commenced until some months after the abortion, but this is quite exceptional, and, as Haultain suggests, it is possible that in the interval the patient has, had another abortion. The hæmorrhage, is, as a rule, considerable in amount. In Smyly's case, as in others recorded, it was so severe that the patient was on the point of death from syncope. In the intervals between the attacks of hæmorrhage, there is a more or less fœtid, watery, and blood-stained discharge. The patient's general condition becomes worse each day as a result of the previous hæmorrhages; cachexia is caused by absorption of ptomaines from the fungating growth, and by the occurrence of metastases in a later stage. Her temperature rises as soon as intra-uterine decomposition occurs, and assumes a hectic type. Usually, the first symptom of metastases is the occurrence of a persistent cough due to extension to the lungs, auscultation of which will reveal the existence of patches of pneumonia.

On vaginal examination, the cervix is found to be sometimes closed and sometimes patulous. If the finger is passed into the uterine cavity, a fungating growth is felt which more or less fills the cavity according to the stage it has reached, and which breaks down readily under the finger. The body of the uterus also enlarges rapidly in proportion to the growth of the tumour, and may rise above the level of the pelvic brim.

Diagnosis.—The diagnosis of this condition is not difficult, once our attention is directed to the possibility of its occurrence. It cannot be too strongly insisted upon that, in all cases in which hæmorrhage recurs after pregnancy, the patient should be carefully examined bi-manually. If the uterus is not enlarged, it will be sufficient to curette it and examine the scrapings microscopically, but, if it is enlarged, the finger should be passed into it and the cavity explored. A chorion-epithelioma may, in an early stage, be confounded with a small sub-mucous myoma; a distinction can be made by noting the ease with which the growth is broken down with the finger-nail or curette in the former case. In a later stage, it may be mistaken for portions of retained and decomposing placental tissue. As the retention of such fragments is always possible after abortion or labour, this is a very natural and probable mistake to make. It can, however, be guarded against, first, by noting that it is impossible to remove all the fungating mass which fills the uterine cavity in the case of a chorion-epithelioma, while this can as a rule be easily done in the case of retained portions of placenta; and, secondly, by submitting the removed fragments to microscopical examination at the hands of a competent microscopist. In selecting portions for microscopical examination, the superficial parts of the growth must be avoided, as these usually consist of little but necrosed tissue and blood-clot. The characteristic appearances will only be found when the removed portion comes from the neighbourhood of the spreading edge of the growth.

Occasionally, it happens that a case occurs in which the usual hæmorrhages are absent, as in one recorded by Williams, where the first evidence of the disease was furnished by metastatic deposits in the vagina. The absence of hæmorrhage in such cases is probably due to the depth at which the growth starts in the uterine wall. Here, early diagnosis is practically impossible, but it is satisfactory to know that, sometimes at any rate, after extirpation of the uterus the vaginal or other metastases may disappear, being apparently killed by the clotting round them of the hæmorrhage to which they gave rise. The cases recorded by Lonnberg and Manheimer,* and Freund,† are notable instances of this. The vaginal metastases first occur as soft, purplish swellings, which rapidly ulcerate on the surface and break down, leaving behind an irregular ulcer. Such metastases may be found not only on the vaginal walls, but also on the vulva.

Treatment.—There is only one treatment applicable to chorion-epithelioma. It is a malignant growth, and must be treated accordingly. Complete extirpation of the uterus alone affords any hope of cure, and must be adopted in every case, as soon as the condition is recognised. The presence of metastases is not a contra-indication to operation, which should be performed whenever the condition of the patient offers a hope that she will be able to stand the attendant shock.

Prognosis.—The prognosis of chorion-epithelioma when not operated upon is, so far as we at present know, absolutely bad, death occurring within a period varying from some weeks to six months, according to the rapidity with which the tumour grows. Death may be directly due to hæmorrhage, to septic absorption, or to metastatic pneumonia. If the uterus is completely removed before the occurrence of metastases, the prognosis is good. Haultain found thirty cures amongst ninety cases, and many of those which terminated fatally were not operated upon. As has been already mentioned, the presence of metastases is not a contra-indication to operation. Not only have cases in which there were deposits in the vagina been cured, but also cases in which there were deposits in the ovary (Cazin*), and in which there was evidence of pulmonary metastases as shown by the presence of hæmorrhagic sputum, and other symptoms (Chrobak† and Von Franqué‡). Such cases are accounted for, according to Haultain, by the peculiar character of the malignant cells, which apparently grow freely only in circulating blood, and rapidly degenerate and die in extravasated blood. It is possible, therefore, that the cells in the metastases may, by becoming as it were choked in the hæmorrhage to which they give rise, be cut off from that free circulation which is so essential to their continued activity, and rapidly die.

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* *Centralb. f. Gyn.*, 1896, p. 474.

† *Zeits. f. Geb. u. Gyn.*, 1896, vol. xxiv., Hft. 2.

HYDRAMNIOS

Hydrops amnii or hydramnios is the term applied to an excessive quantity of liquor amnii. It is difficult to say what is the exact amount of fluid which constitutes hydramnios, but in practice we may consider any quantity up to two pints at full term to be not excessive, and over two pints to be excessive. Cases in which the uterus contained as much as twenty pints, or even more, have been met with, and to this condition the term polyhydramnios is applied.

Frequency.—The relative frequency of hydramnios is said to be from 1 in 100 to 1 in 150 cases. At the Rotunda Hospital, hydramnios was found 109 times in 20,000 cases, a proportion of 1 in 183·58.

Varieties.—Two forms of hydramnios are met with, an acute form which comes on very rapidly, perhaps, in the course of a single night, and a chronic form in which the increased quantity of liquor amnii gradually accumulates during the second half of pregnancy.

Ætiology.—Strictly speaking, hydramnios is not a definite disease, but rather a symptom of a considerable number of widely differing pathological conditions present in either the ovum or the mother. We may then classify the various causes of hydramnios into two groups:—maternal causes, and ovular causes. The principal maternal pathological conditions which may be associated with hydramnios are renal disease, cardiac disease, and anæmia and hydræmia. The manner in which they act is obscure. Maternal syphilis may also be a cause, but whether it acts directly or—as is more probable—by producing various fœtal lesions is uncertain.

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* *La Gynécologie*, 1896, p. 15.

† *Centralb. f Gyn.*, 1896, p. 1281.

‡ *Zeits f. Geb. u. Gyn.*, 1896, vol. xxiv., Hft. 2.

The principal fœtal conditions which are associated with hydramnios are as follows:—

(1) Multiple pregnancy, particularly in the case of uni-ovular twins. In such cases as a rule only one amniotic sac is affected, and according to McClintock it is usually the second sac. The reason for the occurrence of hydramnios in these cases is obscure. It has been suggested that on account of the communication between the two fœtal circulations, the blood-pressure in one fœtus may be greater than that in the other, and thus a circulatory stasis be produced in the latter (Frankenhauser), this stasis in turn causing transudation from the blood-vessels. The acute form of hydramnios is most frequently met with in cases of twins.

(2) Fœtal malformations.—The most commonly found fœtal malformations are anencephalus, hydrocephalus, and spina bifida. Hydramnios is also found in association with almost every form of fœtal intra-uterine lesion, and especially, perhaps, in the case of lesions that are dependent upon syphilis. It has been suggested that in cases in which the covering of the brain is deficient, the hydramnios is due to polyuria caused by the stimulation of cerebral centres by pressure or by contact with the liquor amnii.

(3) Abnormalities of the funis, placenta and membranes.—In some cases of hydramnios, the umbilical cord is found to be longer than normal, or to be partially constricted by twisting round the fœtus, by knotting, or by diminution in the calibre of its vessels. In some cases, there is persistence of the vessels of Jungbluth*—a capillary plexus which has been described in early fœtal life between the amnion and the fœtal surface of the placenta. In other cases the placenta is hypertrophied, syphilitic, or studded with infarctions. Lastly, in a few cases, there is a thickened condition of the membranes.

In view of the numerous and widely different conditions with which hydramnios is associated, it is difficult, and at present impossible, to form any exact idea regarding its pathology. Ballantyne,† who discusses the subject at length, points out that hydramnios may be regarded as the persistence of a state which is physiological in the early months of pregnancy, as at that time the liquor amnii weighs more than either the fœtus or the placenta and membranes, or that it may be a symptom of various antenatal pathological conditions. He adopts, as will most men, the latter alternative, and considers that hydramnios may be due to a chemical irritant, which comes from the mother or the fœtus, and which excites a flow of lymph or serum ; it may be due to increased pressure in the umbilical vein and its branches, arising from various fœtal diseases and deformities ; it may be the result of changes in the maternal blood which allow increased transudation ; or it may possibly represent fœtal urine or cerebro-spinal fluid.

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* *Archiv f. Gyn.*, vol. iv., p. 554, 1872.

† 'Antenatal Pathology and Hygiene,' vol. i., p. 405.

Symptoms.—In the acute form of hydramnios, the increase in size of the uterus comes on very rapidly, perhaps in a single night, but more usually in from a couple of days to a week. The symptoms are similar to those which will be described under the chronic form, save that they are, as a rule, more severe on account of the rapidity with which the increase in the liquor amnii occurs.

In the chronic form of hydramnios, the intensity of the symptoms depends upon the amount of fluid present, and the pressure which results upon the abdominal and thoracic viscera. The abdomen becomes considerably distended, and, in some cases, this may reach such a degree that the patient is unable to leave her bed. The usual symptoms are due to pressure upon the bladder causing frequent micturition, upon the intestines causing constipation and intestinal atony, upon the stomach causing nausea and vomiting, upon the heart causing palpitation, and in extreme cases threatened or even actual failure, and upon the lungs causing dyspnœa. The action of the kidneys is also interfered with and the quantity of urine diminished, while albumen and tube casts may make their appearance in the latter. Lastly, as a result of pressure upon the intra-abdominal bloodvessels, and the vessels of the abdominal wall, œdema of the legs, vulva, and lower part of the abdominal wall, also occurs. If the pressure is long continued, the symptoms may become so acute as to threaten the life of the patient.

As a rule, the over-distension of the uterus determines the premature onset of labour, and during this process a fresh train of complications are met with. The over-distension leads to atony of the uterine muscle, and, in consequence, the strength of the uterine contractions is interfered with, and labour is prolonged. This prolongation particularly affects the first and the third stage, while the second stage may be precipitate. The cause of precipitation in this stage is to be found in the small size of the fœtus—the result of prematurity, and also, perhaps, of the particular pathological condition which gave rise to the excess of liquor amnii. On account of the quantity of fluid in the uterus, the normal adaptation between the shape of the latter and the shape of the fœtus is altogether lost, and abnormal lies and presentation of the fœtus are of common occurrence. Even if the vertex presents, the head remains above the pelvic brim during the first stage, and does not fill the lower uterine segment.

In consequence of this, the membranes protrude unduly into the vagina during a contraction, and rupture prematurely. The ill effects of the latter occurrence are never so clearly seen as in hydramnios. Usually, its only result is that labour is prolonged owing to the loss of the dilating action of the bag of waters In hydramnios, however, much more serious consequences follow, on account of the sudden escape of the large collection of fluid, and the consequent rapid diminution in the size of the uterus. The sudden rush of liquor amnii may sweep down a loop of the umbilical cord or a limb of the fœtus, and at the same time may sweep the fœtus into a malposition, if it was not already in one; while the rapid diminution in size of the uterus may cause the detachment of the placenta. Atony of the uterus during the third stage may lead to the slow detachment or retention of the placenta and to post-partum hæmorrhage.

Diagnosis.—The diagnosis of hydramnios is made by determining, first, the existence of pregnancy; then, the fact that the abdominal tumour is formed by the uterus; and, finally, that the increase in size in the latter is the result of an accumulation of fluid, and not of multiple pregnancy. It is unnecessary to again enter into the methods of diagnosing the existence of pregnancy, inasmuch as they have been already fully discussed. It is sometimes extremely difficult to ascertain definitely that the abdominal tumour is formed by an enlarged pregnant uterus. It may be difficult or impossible to palpate the fœtal parts, or to hear the fœtal heart on account of the interposition of fluid between the fœtus and the abdominal wall, and, consequently, all that is felt is a large cystic tumour, which does not always present the usual ovoid shape of the uterus. Similarly, it may be equally difficult or impossible to reach the presenting part by vaginal examination. The diagnosis has then to be made between a pregnant uterus, a cystic tumour of the ovary or of the uterus, and ascites. If the condition present is uncomplicated, the diagnosis is usually easy. In a case of intra-uterine pregnancy, there is a cystic tumour, corresponding in size and position to the uterus, the subject of alternate contraction and relaxation, and apparently continuous with the vaginal portion of the cervix. It may be possible to detect fœtal parts and to hear the fœtal heart, but in cases of considerable accumulation of fluid it will be impossible to do so. In the case of an ovarian tumour, we get a history of slower growth, and, on bi-manual examination, it is possible to differentiate between the tumour and the uterus. In a fibro-cystic tumour of the uterus, the history is also different, and the characteristic signs of pregnancy are wanting. In ascites, the fluid changes its position on moving the patient, the dulness on percussion over the abdomen extends into the flanks, and a wave of fluctuation can usually be obtained. Whenever any of these conditions complicate a case of hydramnios, the difficulty of making a diagnosis is very much increased, and may sometimes only be made by waiting until the onset of labour clears up the nature of the case.

Once it has been determined that the tumour is formed by a pregnant uterus alone, the diagnosis of the cause of its unusual size is not difficult. There are four conditions which make a pregnant uterus larger than normal, and these are multiple pregnancy, vesicular mole, concealed hæmorrhage, and hydramnios. In multiple pregnancy, the fœtal parts can be readily palpated, and the increase in size of the uterus in proportion to the period of pregnancy is not very marked. One or more fœtal hearts can also be heard. In vesicular mole, there is a history of repeated attacks of a watery blood-stained discharge, and the uterus is, as a rule, softer and more boggy in consistency than in hydramnios. In concealed accidental hæmorrhage, there is a history of the sudden onset of the hæmorrhage and the usual symptoms of hæmorrhage. The diagnosis of hydramnios is thus arrived at by a process of exclusion.

Treatment.—The treatment of hydramnios is straightforward and obvious. During pregnancy, there is no reason to interfere unless the symptoms become acute, when it may be necessary to induce premature labour. This is best done by puncturing the membranes and allowing the liquor amnii to drain away gently, as by this means any acute pressure symptoms are immediately relieved, and labour is at the same time brought on. If, however, the symptoms are not very severe, it is sufficient to recommend the patient to refrain from an undue amount of exercise and from occupations which necessitate standing or walking, to wear an abdominal belt, to regulate the bowels, and to watch the action of the kidneys with a view to ascertaining that a sufficient quantity of urine is passed. Some authorities—notably Pinard—advise the routine administration of mercury and iodide of potassium in these cases, in consequence of the frequency with which hydramnios is associated with syphilis. Whether this course is adopted or not, a history of syphilis should always be sought for, and, if there is any reason to suspect its presence, antisyphilitic treatment must be adopted.

When labour comes on, we must endeavour to prevent premature rupture of the membranes and the sudden escape of the liquor amnii. With these objects, the patient is kept in bed from the commencement of the pains, and any attempts at straining or bearing-down forbidden. As soon as the os is half dilated, it is advisable to rupture the membranes artificially, and to allow the liquor amnii to drain away slowly. To do this, the fingers are introduced into the vagina and passed upwards a little way inside the uterine orifice. Then, by means of a sterilised stilette or knitting-needle, the membranes are punctured as high up as can be reached under the guidance of the finger. The fingers must be kept in the uterine orifice while the liquor amnii is escaping, as by this means its too rapid escape is prevented.

As soon as it has all escaped, the nature of the presenting part is ascertained. If the latter is normal, there is no further reason to interfere, but, if a malpresentation is present, it must be corrected.

If the contractions of the uterus are too feeble to expel the fœtus, it may be necessary to apply the forceps. In all cases of hydramnios, the necessary means of treating post-partum hæmorrhage, should it occur, must be at hand.

Prognosis.—The maternal prognosis in hydramnios is not serious if the case is under surveillance from the onset of the condition, as, if the symptoms became at any time so severe as to threaten life, labour can be immediately induced. In cases of considerable accumulation of fluid, in which the patient has neglected to obtain advice, death may result from debility dependent on the non-assimilation of sufficient nourishment, from pulmonary disease, from cardiac failure, or from suppression of urine. The fœtal prognosis is unfavourable, both in consequence of the pathological conditions which are so frequently associated with hydramnios, and of the complications which may arise during labour. According to Winckel, only one-third of the infants survive.

OLIGO-HYDRAMNIOS

By the term 'oligo-hydramnios' is meant the absence or insufficiency of liquor amnii. In some cases, the entire amount of liquor amnii may be only one or two drachms. It is a rare condition.

Pathology.—It is as difficult to determine the exact pathology of oligo-hydramnios as that of hydramnios. All that can be said is that the condition is associated with much the same fœtal diseases and abnormalities as is hydramnios (Ballantyne*), and that the only malformation which would seem to be more common in this condition than in hydramnios is ankylosis of the fœtal joints. This may perhaps be accounted for by the diminished power of movement on the part of the fœtus owing to the absence of liquor amnii, and so must be considered as a consequence and not a cause of that absence. The condition of the fœtal urinary apparatus does not bear any fixed relation to either hydramnios or oligo-hydramnios, inasmuch as both these conditions have been found in association with absence of the kidneys, and with cystic kidneys the result of urinary obstruction. From this, it would appear as if the amount of urine excreted had little or nothing to say to the amount of liquor amnii. This view is supported by the results of the experimental administration of phloridizin. This drug, when administered to the mother, is followed by the secretion of sugar by the maternal and fœtal kidneys. Investigations of thirty-four pregnant women and four animals failed, however, to determine the presence of sugar in the liquor amnii after the administration of the drug, and, consequently, apparently proved that the fœtus had not passed urine after its administration (Schaller). Various pathological changes in the placenta and membranes have also been found in association with oligo-hydramnios; they are, however, very similar to those which have been already described as sometimes present in hydramnios.

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* *Op. cit.*

Symptoms.—The symptoms, if any, to which this condition gives rise during pregnancy are too slight to be noticeable. Subsequently, labour may be tedious in consequence of the loss of the dilating effect of the bag of waters. The most serious consequence of oligo-hydramnios is, however, its effect upon the membranes. In consequence of the insufficiency of liquor amnii, the amniotic sac collapses, and the walls come into contact with one another. Adhesions then form at the points of contact, and, as the fœtus increases in size, these adhesions are drawn out into bands, which may in turn become wrapped round the fœtal limbs, and, by tightening on the latter, cause their strangulation or actual amputation. In this manner, intra-uterine amputations are caused.

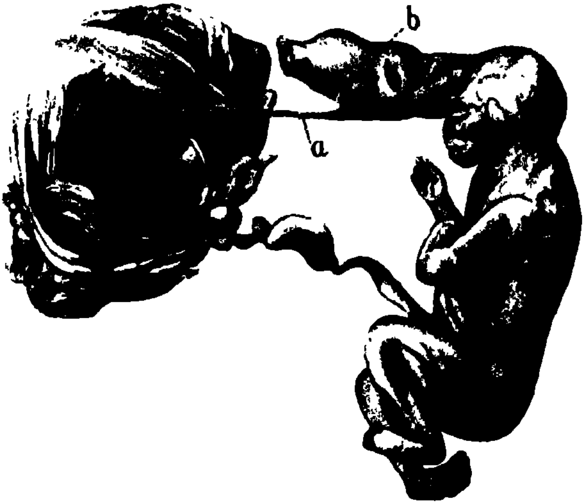

FIG. 268.—OVUM, SHOWING AMNIOTIC ADHESIONS.
a, Adhesion, *b*, meningocele
(From a preparation in the School of Physic, Trinity College, Dublin.)

Diagnosis.—The condition cannot be diagnosed until the membranes rupture, and the liquor amnii is found to be insufficient or practically absent. In the case of a thin patient, perhaps, the existence of the condition may be suspected by noting the unusually distinct manner in which the fœtal parts can be felt, and the irregular shape of the uterus during a contraction.

Treatment.—There is no treatment applicable to this condition, as the complications to which it gives rise cannot be prevented.

Prognosis.—The maternal prognosis is not materially affected by the existence of oligo-hydramnios. The fœtal prognosis is, however, more serious, as will be readily understood. The absence of liquor amnii renders the fœtus more liable to injury from blows or pressure on the abdomen of the mother, and also renders the placental circulation liable to interference, while, if amniotic adhesions form, they may result in the death or crippling of the fœtus.

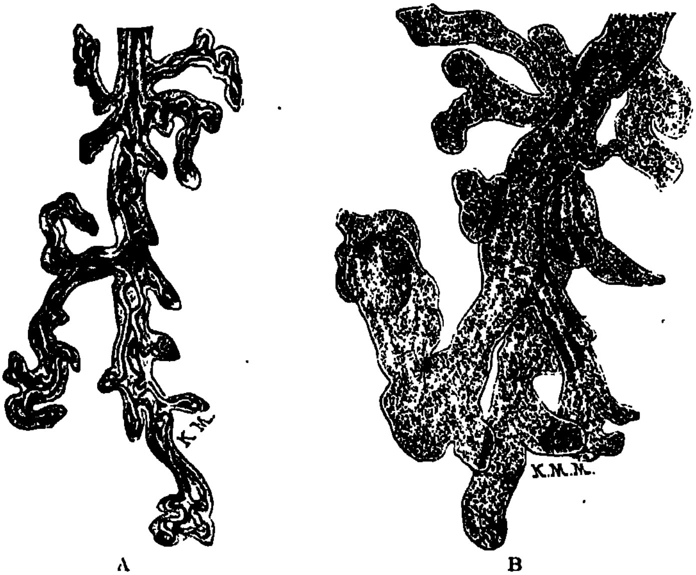

FIG. 269.—NORMAL (A) AND SYPHILITIC (B) CHORIONIC VILLI TEASED OUT IN SALT SOLUTION, AND SLIGHTLY MAGNIFIED. (Williams.)

SYPHILIS OF THE OVUM

The Membranes and Placenta.—From the investigations of Fraenkel, of Breslau,* it appears that the chorion is the chief seat of disease in the ovum. The villi are invaded by a dense growth of round or spindle cells, which gradually encroach on and cause the disappearance of the vascular loops, and ultimately end in a process of fatty degeneration. The villi so affected are readily isolated from their surroundings; they are swollen, opaque, and rather bulbous at their extremities. This condition may be found in localised areas scattered through the chorion, or it or the placenta may be uniformly affected.

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* *Archiv für Gynäkol.*, vol. v., pp. 1-54, 1873.

The changes met with in the placenta of syphilis are, as a rule, fairly constant. They are not, however, invariably present, nor, according to Ballantyne,* absolutely characteristic, though they are usually sufficiently marked to draw attention to the existence of some pathological condition, and to the probability of that condition being syphilis. The placenta is usually considerably larger than normal, and is of a pale-red colour interspersed with yellowish patches. It is sometimes soft and even friable. Its increase in weight in proportion to the weight of the fœtus is especially marked in cases in which the fœtus is born dead, and in such cases its weight is to that of the fœtus as one is to four, instead of the normal proportion of one to six.† This increase is also present in the case of a fœtus which is born alive, though it is not then so marked.‡ The most characteristic histo-

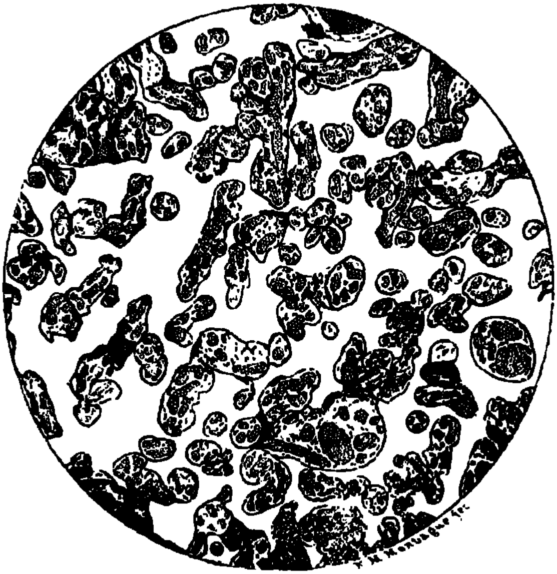

FIG. 270.—NORMAL FULL-TERM PLACENTA. 50. (Williams.)

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* *Op cit.*, p. 230

† C. Ruge, *Zeitschr. f. Geburt. u. Gynäk.*, vol i., p 57, 1877

‡ Correa Diaz, Thèse de Paris, 1891.

logical alterations consist in an end-arteritis and peri-arteritis of the vessels, in cirrhotic changes in the connective tissue core, and in proliferation of the epithelial covering of the villi, sometimes of thickening of the chorion, and of arteritis of the vessels of, and minute gummata in, the decidua serotina (Schwab*). The quantity of blood circulating in the fœtal part of the placenta is diminished, and here and there hæmorrhages are met with in the maternal portion. "The so-called gummata of the placenta are probably hæmorrhagic in their origin, or are due to fibrous patches which have become more or less caseous; possibly, however,

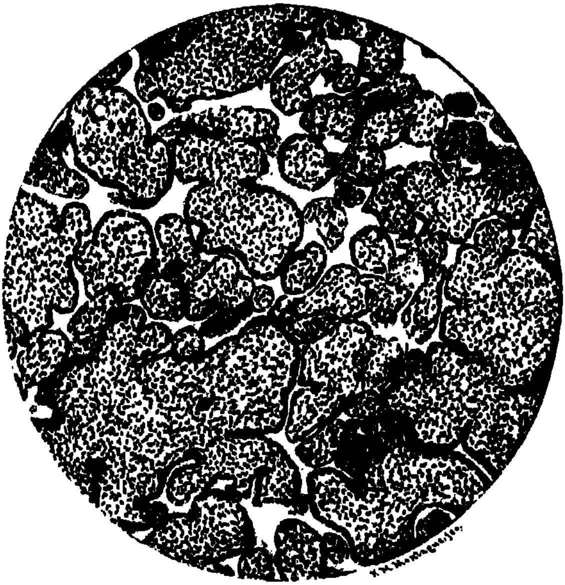

FIG. 271.—SYPHILITIC FULL-TERM PLACENTA. × 50. (Williams.)

true gummata may in exceptional circumstances be met with" (Ballantyne). The macroscopical structures, which used to be described as one of the signs of placental syphilis, are in all probability nodules of fatty degeneration and white infarctions, neither of which possess any relation to syphilitic infection. The older notion that the fœtal portion of the placenta was alone affected in cases in which the infection came from the father—the mother remaining apparently healthy, and the maternal portion in cases in which the infection came from the mother alone is no longer accepted as probable.

The Cord.—Syphilitic lesions of the cord are not infrequently met with. They consist most frequently in endarteritis and periarteritis and in similar lesions of the veins, leading to thickening of their walls and a varying degree of obstruction of their lumen. More rarely, complete or partial absence of the Whartonian jelly has been noticed—a condition which may bring about mutual disassociation of the funic vessels.

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* 'De la Syphilis du Placenta,' Thèse de Paris, 1896.

The Liquor Amnii.—The liquor amnii is frequently increased in amount, probably from a rise of pressure in the umbilical vein from lesions in the placenta, in the cord itself, or in the fœtal liver. Little or nothing is known of the changes in the quality of the fluid.

The Fœtus.—There are two different classes of consequences for the fœtus as pointed out by Fournier in 1898. First, special manifestations of the disease both in the body generally and in the various organs. Secondly, various pathological but non-syphilitic conditions, or *dystrophies*, which are of the nature of imperfections or arrests of development.

The special manifestations of disease may appear at or soon after birth. The most characteristic is an eruption of pemphigus-like bullæ, or in their early stage of circular copper-coloured patches. The bullæ contain at first blood-stained and later purulent fluid, and when they rupture leave irregular and superficial ulcers often covered by a dark crust. These bullæ and ulcers are numerous and of various sizes, some very large; they are well seen about the genitals, but particularly—and this is characteristic of syphilis—upon the palms and soles. The body is small and emaciated, the skin wrinkled, due to the absence of subcutaneous fat, and the general appearance of the infant is senile.

Death of the fœtus is very common. Hecker* made a thorough examination of sixty-two still-born children, and found thirty-three (53 per cent.) syphilitic and six (9·7 per cent.) doubtful. Fifteen out of the thirty-three had to be examined histologically before the diagnosis could be made certain. Death may occur at any period of intra-uterine life, or the child may be born alive in so diseased a condition as to entail its death either at a very early or a later period of infancy. Even if death does not occur, the condition of disease in which the infant is born, though permitting life, may leave it in such a condition of deformity or ill health that early death would have been preferable.

The fœtus when expelled dead is usually in a 'macerated' condition, the cuticle peeling off in large flakes. The liquor amnii is of a dark-brown colour. These appearances are not peculiar to syphilis, as is sometimes supposed, they are found in many other conditions where the fœtus dies and is retained *in utero* for a considerable time. The fœtus is often spoken of as decomposed, but this is not correct unless air has gained access to the fœtus, carrying with it putrefactive bacteria.

In general, the pathological changes found in the different organs consist in diffuse inflammatory processes invading the interstitial tissues from the walls of the smallest vessels. Microscopically, we find a very marked small round-celled infiltration of the vessel walls and neighbouring connective tissue; and this infiltration is accountable for the increased size and greater firmness which form the chief macroscopic evidences of congenital syphilis. In the case of some organs specially liable to attack, there results a considerable hyperplasia of fixed cell elements. Except, however, for one accustomed to the normal characteristics of fœtal organs, the macroscopic alterations are not clearly marked, and it must be on microscopic examination that a certain diagnosis rests.

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* *Deutsch. Med. Woch.*, November 6 and 13, 1902.

Of late years, much importance has come to be attached to a special form of osteo-chondritis, as affording the most constant, as well as probably the earliest, evidence of syphilis. This is an inflammatory process, which affects long bones and ribs at the junction of the diaphysis and epiphysis. At term, the line of junction is normally 0·5 mm. broad, while in syphilitic osteo-chondritis it is 2 to 3 mm. broad, and sends out irregular processes into the cartilage and more markedly into the diaphysis. It is further characterised by its intense yellow colour. These changes may, before or after birth, progress to epiphysary separation. They can be readily studied on a longitudinal section through epiphysis and diaphysis of the lower end of the femur. This is the practical *post-mortem* macroscopic test which is uniformly adopted in Germany. Its finer microscopic details do not concern us here.

Next in importance come the changes in the liver. They appear about the 16th week, and are never wanting (Hochsinger) in the syphilitic still-born. The liver is larger and firmer than normal, with rounded borders and increased weight. These signs apply mostly to children born alive or but recently dead, and where maceration has occurred the liver may be flaccid or soft. On section, the liver substance may appear more translucent than is usual, with a 'flinty' appearance and loss of lobular demarcation, or a number of miliary gummata can be seen through the transparent serous covering, scattered over the surface, and giving the semolina grain appearance noted by Virchow. Large gummata are quite exceptional. The most constant of all appearances is the histological one of a diffuse small-celled infiltration, having the smaller vessels as a starting-point, and spreading out so extensively over the entire liver as on first glance largely to conceal the liver cells themselves.

In congenital syphilis, enlargement of the spleen is constant. In healthy children at term, this organ weighs approximately ten grams; in congenital syphilis, it may weigh from two to four times as much, and this enlargement is probably related rather to the extreme anæmia that is present in such cases than to a specific cause.

The kidney changes have been particularly studied by Hochsinger, who describes a diffusely-spread proliferation of intertubular connective tissue, as also occasional glomerulo-nephritis. Nephritis is certainly frequent in such cases, and fœtal urine has been found on examination to contain albumen and fatty casts. The lungs frequently show well-marked changes, of which the chief are a diffuse gelatinous infiltration, whitish solid patches—pneumonia alba syphilitica—in which groups of air vesicles are filled with epithelial cells undergoing fatty degeneration, and interstitial fibroid pneumonia.

With the manifestations of non-syphilitic nature—'*stigmates dystrophiques de l'hérédito-syphilis*' (Fournier)—we have little to do in this book, and must confine ourselves to mentioning only the principal. Fournier divides them into the following groups:—

(1) General dystrophies, such as the simian or senile physiognomy.

(2) Partial dystrophies, such as anencephalus, meningocele, harelip, clubfoot, ectopia vesicæ, ichthyosis, and many others.

(3) Dystrophies of intellectual development—viz., retarded or arrested development.

(4) Dystrophies of predisposition—*e.g.*, hæmorrhagic diathesis, tubercle, nervous diseases.

Fournier also mentions many other conditions which he does not consider as dystrophies peculiar to syphilis, but which are met with in sufficient frequency in syphilitic cases to shew that they are not mere coincidences, but a real relation of cause and effect.

These effects of syphilis on the fœtus and fœtal appendages are greatly modified by the following circumstances:—

(1) The time in relation to pregnancy at which infection takes place. Fournier's tables show that, when infection occurred before conception, the fœtal mortality is 65 per cent. and the morbidity (*i.e.*, evidence of disease) 70 per cent.; when conception and infection occur simultaneously, the mortality is 75 per cent. and the morbidity 91 per cent.; while, when the infection has taken place after conception, the mortality is 39 per cent. and the morbidity 72 per cent.

(2) The source of the infection. Fournier's tables show that, when the father alone is responsible, the mortality is 28 per cent. and the morbidity 37 per cent.; where the mother is the transmitter, 60 per cent. and 80 per cent.; and where both parents transmit, 68·5 per cent. and 92 per cent.

(3) The age of the disease in the transmitter. The first three years of infection are the most fatal to pregnancies, and the first year, including the period of secondary manifestations, is much the worst. Of ninety women who became pregnant during the year following their infection, only two gave birth to children who survived. As the disease becomes older, the danger becomes less. It is said (Hutchinson) that the liability to transmit the infection to the ovum ends in two years in the case of the father, but is extended in the case of the mother to seven or eight

years, while exceptional cases have been recorded in which transmission occurred after ten or fourteen years. We doubt, however, that in the case of the father an interval of two years since infection is sufficient to ensure immunity. Hutchinson also thinks that in the case of the woman the virus may be stored up in the ovaries and may infect the germs of future children.

(4) The adoption of treatment. This no doubt profoundly modifies the course of events, and will be discussed later (v. Part VI., Chapter IV., sections on Maternal Syphilis).

ANOMALIES AND DISEASES OF THE PLACENTA

Anomalies of Position.—Under normal circumstances, the placenta is situated in the upper uterine segment, and on either the anterior or the posterior wall. According to some writers, it is situated as frequently on the anterior wall as on the posterior (Gusserow and Hennig*), but according to others it is most frequently situated upon the posterior wall. Pinard and Varnier† found the following proportion in 37 cases which they examined:—

Number of Cases.	Situation.
22	Posterior wall.
12	Anterior wall.
1	Fundus.
1	Right lateral wall.
1	On both anterior and posterior wall (triplets).

The only situation of the placenta which can be regarded as abnormal is that in which any portion of it extends into that part of the uterus from which the lower uterine segment is formed. According to Barnes,‡ the placenta must be considered to be abnormally situated if it approaches within three inches of the undilated internal os. This distance is perhaps a little too great. A placenta which is inserted in the lower uterine segment is termed *placenta prævia*, in consequence of its position in front of the presenting part, and as a rule gives rise to serious ante-partum hæmorrhage. This will be again referred to at length in discussing the hæmorrhage of pregnancy, and, consequently, need not be dealt with here.

Anomalies of Size and Shape.—A *placenta membranacea* is the term applied to a large and thin placenta, the result of persistence of the chorionic villi over a large portion of, or even over the entire, ovum. The practical importance of such a condition is that, during the third stage, detachment is difficult, owing to the thin placenta crumpling up inside the contracting uterus.

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* *Monatss. f. Geburts.*, vol. xxvii., p. 90, 1866, and 'Studien über den Bau der Placenta,' Leipzig, 1872.

† 'Étude d'Anatomie Obstétricale Normale et Pathologique,' p. 2, Paris, 1892.

‡ 'Obstetric Operations,' third edition, p. 494.

A *placenta succenturiata* is the term applied to the condition in which the placenta, instead of being a single organ, is divided into two or more lobes (*v.* Fig. 272). These lobes are connected with one another by branches of the umbilical vessels, which run across the membranes. If there are two almost equal lobes, the condition is known as a bi-lobed placenta. A placenta succenturiata is of considerable practical importance on account of the danger of one of the smaller portions being left behind after labour. Fortunately, in the majority of cases, such an occurrence will give rise to immediate post-partum hæmorrhage, and in the process of checking the latter, the retained piece of placenta will be found and removed. If, however, there is no immediate hæmorrhage, and the retained portion is undiscovered, secondary post-partum hæmorrhage may occur, or the retained portion may become putrid and give rise to sapræmia. It is, then, most important to recognise the existence of a placenta succenturiata, and it is always possible to do so if the necessary precautions are taken to examine the placenta and membranes after their expulsion. Where a placenta succenturiata has been left behind, a gap will be found in the membranes corresponding to the retained portion

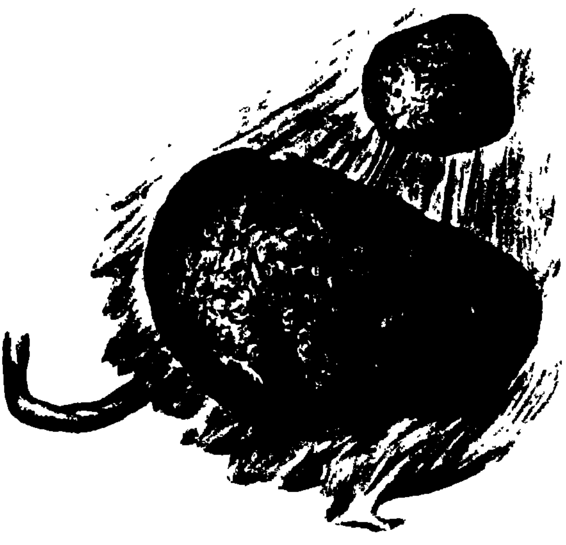

FIG. 272.—A PLACENTA SUCCENTURIATA.
P′, Main placenta; P″, secondary detached lobe.

of placenta, and branches of the umbilical vessels will be found running to the edge of the gap. In such a case, the uterus must always be explored with the fingers and the retained fragment removed.

A *placenta marginata* is the term applied to a placenta in which the membranes instead of being attached round the edge are attached some little way inside the edge, in such a manner that a margin of placenta projects all round outside their attachment. According to Küstner this condition is due to an unequal rate of growth of the uterus and the placenta respectively, with the result that the maternal portion of the placenta becomes larger than the fœtal portion. Klein,[*] on the other hand, considers that the condition is due to a marginal thickening of the decidua reflexa, as a result of some inflammatory process such as decidual endometritis. A marginal placenta interferes with the development of the fœtus, as is to be expected in view of the fact that the area of interchange between the fœtal and maternal blood is lessened. In a series of forty cases, collected by R. Martin,[†] 45 per cent. of the infants weighed less than four and a half pounds.

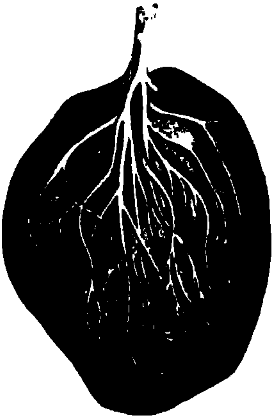
FIG. 273.—A 'BATTLEDORE' PLACENTA.

A battledore placenta is a placenta in which the insertion of the umbilical cord is at the edge instead of being more or less in the centre (*v.* Fig. 273). It is more correctly considered to be an abnormality of the cord rather than of the placenta.

Tumours.—Tumours—*i.e.*, new growths—of the placenta are of extremely rare occurrence. Thirty-six cases have been collected

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[*] 'Zur Enstehung der Placenta marginata, in die menschlichen Placenta.' Wiesbaden, 1890.

[†] Ribemont-Dessaignes and Lepage, 'Précis d'Obstétrique,' 3rd edit., p. 706.

(Albert*), but it is probable that some of these may not have been new growths. These cases consisted of myxoma fibrosum, 14; fibroma, 10; angioma, 9; sarcoma, 2; hyperplasia of chorionic villi, 1. Myxoma fibrosum was described by Virchow, and is the commonest tumour met with. It consists of solid masses of fibro-myxomatous tissue, occurring either as a single tumour or as multiple nodules scattered through the placenta. It is in all probability identical with the tumours already mentioned in which hyperplasia of the chorionic epithelium is associated with hypertrophy of the stroma of the villus. Chorio-epithelioma is not included in Albert's list, although it is as true a placental tumour as is myxoma fibrosum. It is probable, to say the least, that the cases recorded as sarcoma were instances of chorion-epithelioma or possibly of fibroma. 'Hyperplasia of the chorionic villi' was probably a stage in the formation of vesicular mole.

Cysts.—Two forms of cysts of the placenta are met with, both of which are situated on the fœtal surface. The commoner form is a hæmorrhagic or blood cyst. It is usually situated under the chorion, and may be single or multiple. It is probably produced by the rupture of small vessels, and contains a stratified fibrinous lining inside which is a little blood-stained serous fluid or blood. The second form of cyst is found in the substance of the sub-amniotic chorion (Eden), and is probably produced by a myxomatous degeneration of the chorionic connective tissue. It may occur as a single cyst or as multiple cysts. The cysts are usually about the size of a pigeon's egg, and contain a clear viscid fluid. They do not interfere with the functions of the placenta.

Œdema of the Placenta.—Œdema of the placenta may, apparently, occur in association with either maternal or fœtal œdema, and is dependent upon similar causes. The most frequent of these causes—so far as the fœtus is concerned—is some defective condition of the heart or blood-vessels, such as fœtal endocarditis, a closed foramen ovale, or thrombosis of the umbilical and hypogastric vessels. An œdematous placenta has also been met with in cases of an acardiac fœtus, diaphragmatic hernia with presumed compression of the inferior vena cava, transposition of the viscera, and various pathological conditions of the liver. The placenta sometimes reaches a very great size in these cases, and, according to Ballantyne,† may attain a weight of from three to six pounds. It is soft in consistence and very anæmic. The umbilical cord is also usually thick and œdematous, and sometimes friable. There may also be thickening of the chorion and amnion.

As a rule, the fœtus is born dead, either in consequence of interference with the placental circulation, or in consequence of the pathological condition which has caused the placental œdema. Cases, however, have been recorded in which the fœtus was born alive. As antenatal diagnosis of the condition or of its cause is impossible, there is no treatment.

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* 'Ueber Angiome der Placenta,' *Archiv f. Gyn.*, 1898, vol. lvi., pp. 144-159.

† *Op. cit.*, p. 293.

Tuberculosis.—Tuberculosis of the placenta is a very rare condition, but cases have been recorded and definitely proved (Schmorl[*]). As is to be expected they were met with in women suffering from pulmonary or acute miliary tuberculosis. The tubercular lesions present much the same characteristics as in other places. The nodules are found in the substance of the cotyledons more often than upon the surface, and are more abundant in the marginal than in the central parts (Eden[†]). It is interesting to note the condition of the fœtus in cases of placental tuberculosis. Kuss,[‡] who has investigated the subject very fully, considers that even in cases in which the infection reaches the placenta, the latter structure has power to prevent the further extension of the infection. This conclusion, however, cannot be taken as law, inasmuch as cases of antenatal fœtal tuberculosis have been recorded (Hauser, Lehmann[§]). There can be no doubt that the placenta offers a considerable resistance to the passage of bacteria, but inasmuch as other bacteria pass through it there seems to be no adequate reason why tubercular bacilli should not also do so. The only other route by which the infection can reach the fœtus is as a 'water-borne' infection—*i.e.*, through the liquor amnii, and this route though possible is not probable, as it means that bacteria have passed through the membranes.

Calcareous Degeneration.—It is by no means uncommon to find calcareous plates, scattered here and there on the maternal surface of the placenta. These plates can usually be seen, but sometimes are more readily discovered by passing the fingers over the surface, when they are felt as projecting sharp edges or spikes. In some cases, almost the entire face of the placenta has been found covered with a thin plate. These plates are due to a deposit of lime salts in the decidua serotina, and do not affect the fœtal portion of the placenta. Like infarctions, they are probably a sign of 'senility' of the placenta. Their presence has no prejudicial effect upon the fœtus; indeed, according to one writer, the latter is larger than normal (R. Martin[||]).

Placental Infarction.—Infarction of the placenta is a condition of relatively common occurrence. The infarctions vary considerably in size according to their cause, and in appearance according to their age. In an early stage, the infarction resembles a mass of dark clotted blood, and as the colouring matter of the blood disappears, the infarction becomes successively chocolate coloured, then yellowish, and lastly, of a grayish white colour. Williams,* whose work on this subject is well known, summarises his conclusions as follows:—

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[*] 'Die Tuberkulöse der menschlichen Placenta,' etc. Ziegler's Beiträge, xvi. 313.

[†] *Encyc. Medica.*, vol. ix., p. 19

[‡] 'De l'Hérédité Parasitaire de la Tuberculöse Humaine,' Paris, 1898.

[§] 'Zur Vererbung der Tuberkulöse.' *Deutsche Archiv f. Klin. Med.*, 1898, lxi. 221.

[||] Thèse de Paris, 1896.

(1) Infarcts, measuring at least one centimetre in diameter, were found in 315 out of 500 consecutive placentæ.

(2) Smaller infarcts, many just visible to the naked eye, were observed in the great majority of placentæ, while microscopical examination revealed early stages of infarct formation in every full-term placenta.

(3) The primary cause of infarct formation in the great majority of cases is to be found in an endarteritis of the vessels of the chorionic villi.

(4) The primary result of the endarteritis is coagulation necrosis of the portions of the villi just beneath the syncytium, with subsequent formation of canalized fibrin. As the process becomes more marked the syncytium also degenerates and becomes converted into canalized fibrin, and this is followed by the coagulation of blood in the intervillous spaces, which results in the matting together of larger or smaller groups of villi by masses of fibrin. Later, the entire stroma of the villi degenerates, so that the infarct consists entirely of a net-work of fibrin. When infarction is carried to a marked degree, the placenta is converted into a firm yellowish mass containing little blood.

(5) Moderate degrees of infarct formation possess no pathological significance and exert no influence upon the mother or fœtus. They are to be regarded as a sign of senility of the placenta.

(6) Marked infarct formation is not infrequently observed, and often results in the death or imperfect development of the fœtus. It is usually associated with albuminuria on the part of the mother.

We may briefly summarise the ætiology of infarction in a few words. The primary cause of the infarction is to be found in some fœtal condition, while the deposit of fibrin is derived from the maternal blood. The occurrence of small infarctions is due to age changes in the placenta. The cause of large infarctions is, in the great majority of cases, to be found in maternal renal disease. Cardiac disease and syphilis may also give rise to their formation.

The effect of a considerable degree of infarction upon the fœtus is very obvious. In the great majority of cases the latter is below the normal size and in many cases is born dead. This is only what we would expect, inasmuch as a partial limitation of the functionally active area of the placenta is bound to result in a diminution in the supply of nutriment to the fœtus, while a considerable lessening will probably interfere to such a degree as to prevent its further development.

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* *Amer. Jour. of Obstetrics*, 1900, vol. xli., pp. 775-801.

7 **Placenta of Renal Disease.**—The characteristic placenta of renal disease, or the albuminuric placenta, as it is sometimes termed, is, as a rule, easily recognisable. Its chief characteristic is the number of infarcts of different ages which are scattered through it. If the number of infarctions is considerable, the placenta appears atrophied and fibrous. The weight of the placenta is also below the normal. When the infarctions are of recent occurrence they partake more of the nature of thrombosis of the blood in the intervillous spaces. In such cases, the placenta appears to be studded over with numerous globular or oval areas containing dark red, or nearly black, coagulated blood. These areas project on the maternal surface of the placenta, and also lie more deeply in the placental structure. To such a placenta, the name 'placenta truffé' has been given by Pinard.

It is difficult to ascertain what proportion of cases of renal disease are associated with placental infarction. Many cases of renal disease escape notice altogether, and in many other cases the occurrence of albuminuria may have been coincident, or almost coincident, with the onset of labour, and therefore could not cause placental lesions. Martin* in a number of cases has found placental lesions in 47 per cent. of patients who suffered from albuminuria during pregnancy. It is also difficult to ascertain the particular form of renal disease which is most usually associated with placental infarction, but it is obvious that all forms are not equally prone to give rise to it. The kidney of pregnancy does not tend to do so, and a large amount of albumin in the urine is not necessarily associated with a marked degree of infarction (Ribemont-Dessaignes†). It is probable that the most typical cases of albuminuric placenta occur in chronic interstitial renal disease, and that the longer-standing the case is, the more marked the placental lesions will be.

II ANOMALIES OF THE UMBILICAL CORD

1 **Anomalies of Length.**—The average length of the cord at full term is about 22 inches, but considerable variations are not infrequently met with. Neugebauer met with a case in which the length of the cord was 67¾ inches, while, on the other hand, cases have been recorded in which the cord was apparently non-existent, so close was the connection between the fœtus and the placenta. The latter condition is usually associated with umbilical hernia. In practice, every cord must be considered too short which is not equal to the greatest distance during labour between the umbilicus of the fœtus and the insertion of the cord into the placenta. If it is not of this length, tension of the cord will occur, and the expulsion of the fœtus may be delayed, rupture of the cord may occur, or the placenta may be forcibly detached.

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* Thèse de Paris, 1896.

† 'Précis d'Obstétrique,' p. 759.

The excessive length of the cord sometimes results in its coiling round the neck or body of the fœtus, or in the formation of knots. The coiling of the cord round the neck is a very common occurrence even in cases in which the cord cannot be considered to be unduly long, and even in some cases in which it is below the average length. Churchill met with fifty-two cases of coiling in 190 deliveries. In none of these did the cord measure less than eighteen inches; when the cord was twice round the neck it was at least twenty-four inches, and when three times round at least thirty-six inches in length. A case, however, was recorded by another writer, in which a cord measuring thirty-four inches was six times round the neck.* Coiling of the cord round the fœtus is of no importance so long as the loops do not become unduly tight, in fact, in the case of long cords, it may be regarded as a provision of Nature to prevent their presentation and prolapse. If, however, the coils become tightened round the fœtus, the death or deformity of the latter may result from obstruction of the circulation in the cord or compression of the fœtal limbs by the coils; and, in consequence of the shortening of the uncoiled portion of the cord, difficulties may arise during labour as in the case of a cord which was primarily too short.

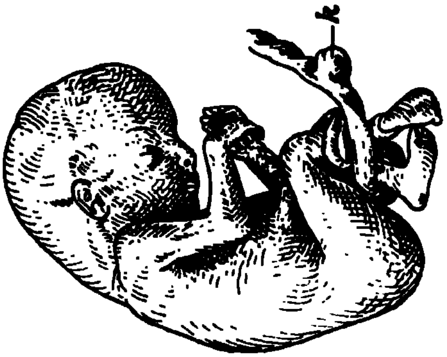

FIG. 274.—COILING OF THE UMBILICAL CORD.
k, A false knot on the cord.

Note the manner in which the cord is twisted several times round the limbs. (From a specimen.)

The formation of knots is a much rarer occurrence. According to Winckel† two conditions are necessary for their formation:—A cord which in length exceeds twice the distance from the umbilicus to the vertex; and a small fœtus or a large quantity of liquor amnii, in order to ensure the mobility of the former.

It is probable that in many cases the knot remains open until labour commences, when the tension imparted to the cord by the descent of the fœtus closes it. When the knot has been tightened during pregnancy distortion of the cord will persist even after it has been untied, owing to the effect of the continued pressure on the Whartonian jelly, while if it has only formed during delivery it can be easily shaken out. It is of course possible that the knot may become so tightly drawn as to offer a partial or complete obstruction to the funic circulation. This, however, very rarely occurs. False knots, due to twisting or dilation of the vessels, or accumulations of Whartonian jelly, are of fairly common occurrence (*v.* Fig. 275). They are readily distinguished from true knots.

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* *Neue Zeitschrift*, vol. xlii., p. 2.

† *Op. cit.*, p. 352.

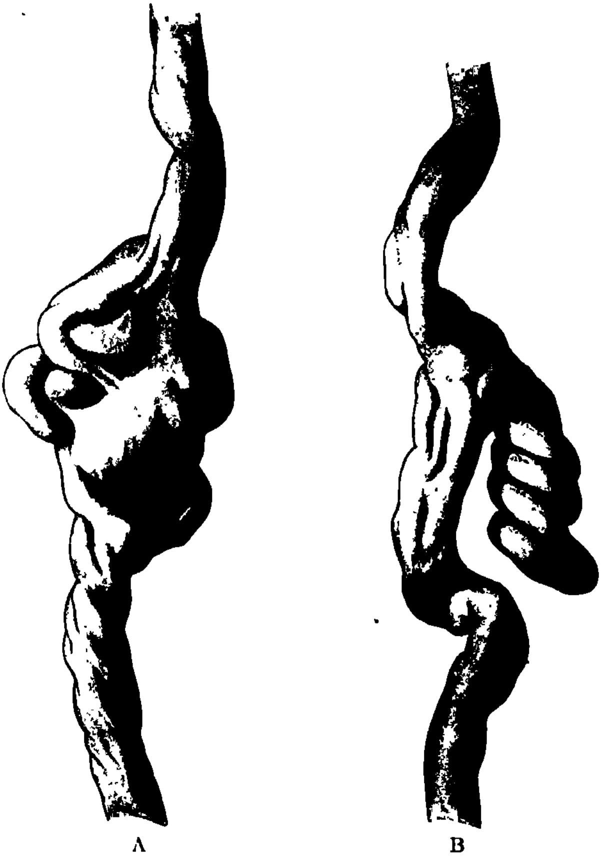

FIG. 275.—FALSE KNOTS ON THE CORD.
A, Large varix of umbilical vein; B, spiral twisting of an umbilical artery. (Bumm.)

Excessive torsion of the cord may also be found in some cases. It is probably due to the same predisposing factors which favour the occurrence of knots, *i.e.*, a long cord, and an abnormal degree of fœtal mobility. To show the extent to which torsion may be carried, we may mention a case recorded by Schauta, in which there were 380 twists. The danger of torsion is that it may produce kinking and obliteration of the vessels.

Anomalies of Development.—The various anomalies of development of the cord are not of any great practical importance, and are never recognised until the birth of the fœtus. They do not tend to interfere with labour, though possibly in some cases they may increase the risk of laceration of the funic vessels during labour, and so affect the fœtal prognosis. The various anomalies which are met with are briefly as follows (Hyrtl*):—

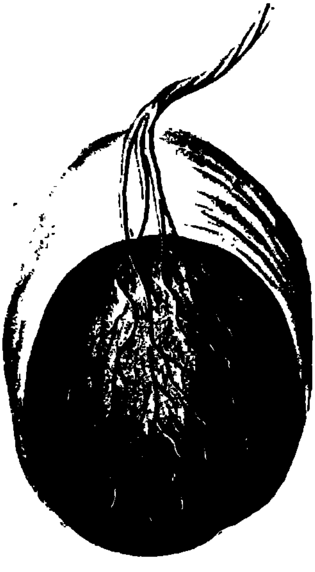

FIG. 276.—VELAMENTOUS INSERTION OF THE CORD.

(1) The vessels may divide at a distance of from two to four inches from the placenta or from the umbilicus of the fœtus.

(2) One vein and one artery are found instead of the normal arrangement of one vein and two arteries. Two veins and one artery have also been found, and three arteries and one vein.

(3) The funis runs as a double cord from the umbilicus to the placenta, the vein in one division, the two arteries in another.

(4) In twins a rare occurrence is fusion of the cords into a

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* 'Die Blutgefässe der menschl. Nachgeburt,' Wien, 1870.

single cord some little distance from the placenta, and then separation as the umbilicus of the fœtus is approached. In a recorded case, there was one artery and one vein in each single cord, while in the common cord there was also only one artery and one vein, each of which bifurcated with the cord.

Abnormal Insertion of the Cord.—In some cases the cord, instead of being inserted into the placenta, is inserted into the membranes, and splitting up at the point of insertion into its usual branches, these run along in the membranes for some little distance before they reach the placenta. To this condition, the term velamentous insertion of the cord is applied (*v.* Fig. 276). Winckel found this anomaly 90 times in 11,000 births, or 0·82 per cent. A curious fact, which he mentions, is association of this condition with abnormal presentation of the fœtus. Shoulder presentation was ten times and pelvic presentation four times, as frequent as in other cases. Velamentous insertion of the cord may prove of danger to the life of the fœtus, especially when the portion of membranes traversed by the cord forms the presenting bag of membranes, as during the rupture of the latter the vessels of the cord may be torn across.

It is possible that in some cases the existence of a velamentous condition may be recognised before the rupture of the membranes by feeling a pulsating artery traversing the presenting membranes. If this was done, the best course to pursue would be to puncture the membranes with a stylette in such a manner as to avoid the vessel, and then to deliver the fœtus with the forceps as soon as the os was sufficiently dilated to allow this to be done.

A marginal insertion of the cord is another anomaly which is sometimes met with. This condition is also spoken of as a battledore placenta, and is of little or no practical importance.

CHAPTER III

PATHOLOGICAL CONDITIONS OF THE UTERUS, THE VAGINA, AND ADNEXA

Displacements of the Uterus: Backward Displacements; Consequences, Restitution, Abortion, Incarceration, Development of the Anterior Uterine Wall—Forward Displacements; Pathological Anteflexion; Pathological Anteversion—Downward Displacements; Prolapse and Procidentia of the Uterus; Prolapse of the Vaginal Walls; Hypertrophy of the Cervix—Hernia of the Pregnant Uterus—Malformations of the Uterus and Vagina—Inflammation of the Vagina and Cervix—Tumours of the Uterus and Ovaries.

THE various pathological conditions, which are met with in the uterus, vagina, and adnexa as causes of complications during pregnancy, will be considered under four heads:—

I. Displacements.
II. Hernia.
III. Congenital malformations.
IV. Inflammation.
V. Tumours.

DISPLACEMENTS OF THE UTERUS

The various displacements of the uterus affect the course of pregnancy according as they interfere with the mobility of that organ or cause congestion of it, and displacements which do not affect the uterus in either of these ways will not be found as pathological factors during pregnancy. The various displacements may be divided into three groups:—Backward displacements; forward displacements; and downward displacements.

BACKWARD DISPLACEMENTS.—So far as the effect upon pregnancy is concerned, the backward displacements of the uterus may be considered together, as that effect differs little whether they are versions, or flexions, or both combined. Backward displacements are the most common form of displacement met with in pregnancy, and inasmuch as they directly interfere with the blood-supply of the uterus and so tend to cause congestion, and under certain conditions interfere with uterine mobility, their effects upon the course of pregnancy are considerable.

If pregnancy occurs in a retro-deviated uterus, or if a pregnant uterus becomes displaced backwards, one or other of the following terminations may result:—Restitution; abortion; incarceration; or anterior development of the uterine wall.

Restitution.—This is, fortunately, perhaps the most common termination which occurs in backward displacement. As the uterus increases in size, it rises gradually upwards out of Douglas's pouch, until, if nothing prevents it—such as an overhanging promontory or pelvic adhesions, the fundus leaves the pelvis and comes to lie in the position proper to the period of pregnancy. Pregnancy then in all probability proceeds normally. In many such cases, restitution occurs before any symptoms draw the patient's attention to her condition, and consequently, the displacement is unnoticed. In other cases, the patient may be led to seek medical advice owing to the occurrence of slight hæmorrhages or of pain. If under such circumstances backward displacement is found, it must in all cases be corrected. As a rule, there is no difficulty in doing this by the bi-manual method. If this method cannot be carried out without an anæsthetic, one must be administered. Reposition should be performed at the earliest possible moment, as, the larger the uterus is, the greater is the difficulty of replacing it, and the more likely is abortion to occur. As soon as the uterus has been replaced, a properly fitting Smith-Hodge pessary must be inserted, and the uterus maintained in position by this means until it has become too large to return to its former mal-position, *i.e.*, until the end of the fourth month. If there is much congestion of the uterus, as shown by the recurrence of slight discharges of blood, small doses of ergot and strychnine may be administered with advantage, as will be presently mentioned when discussing the treatment of threatened abortion.

Abortion.—Abortion is the most common termination of those cases in which restitution does not occur. The position of the uterus tends to obstruct the venous return, and so causes congestion, and congestion is the important predisposing cause of endometritis, which, in turn, is one of the commonest causes of abortion. In addition to favouring congestion, backward displacement of the uterus appears to have some prejudicial effect upon the tone of the uterine muscle. This is easily noticeable during the reposition of a retro-deviated uterus, especially when the latter is pregnant. Prior to reposition, the uterus is flaccid and its outline can be made out with difficulty; but, as soon as it is replaced, it becomes firmer in consistency and is readily palpable, and this condition is not a mere temporary one due to the occurrence of an intermittent contraction, but is in great part permanent, as can be determined by a subsequent bi-manual examination. It is, we think, obvious that the former flaccid condition must be associated with an excess of blood in the uterine sinuses, as the size of the latter is probably to a great extent dependent upon the tone of the muscle fibre, and this excess will in turn tend to cause still further congestion of the uterus and to favour the occurrence of hæmorrhages into the decidua serotina.

Incarceration.—If neither of the foregoing terminations occurs, and if both the pregnancy and the retro-deviation persist, the uterus continues to develop in the pelvis until it fills all the available space. As soon as this occurs, the pressure which is produced upon the neighbouring parts and upon the uterus by the bony pelvis leads to such extensive alterations in the nutrition of these parts, that, unless the pressure is speedily removed by the reposition or the emptying of the uterus, the death of the patient results. To this condition, the term incarceration of the retro-deviated pregnant uterus is applied. It is the most important termination which can occur in these cases, and consequently must be fully discussed.

Frequency.—Incarceration of the uterus is a rare condition, but it is not possible to give any definite figures to show the proportion of cases in which it occurs. As retro-deviations of the uterus are more frequent amongst multiparæ than primiparæ, incarceration will naturally also be more common.

Ætiology.—We are not here discussing the causes of retro-deviation, as such matters more properly concern gynæcology than obstetrics; we are only concerned with the cause of incarceration. Given a backward displacement of the uterus, it is obvious that the occurrence of incarceration will be favoured by the following conditions:—

(1) An Overhanging Promontory, as in a Flat Pelvis.—The importance of this condition as a cause of incarceration is clearly shown by the relatively large proportion of cases in which flat pelvis, or other pelvic deformity in which the promontory projects over the pelvic cavity, is associated with incarceration. The difficulties in the way of restitution are then so greatly increased that in all probability it never occurs spontaneously, and, unless abortion occurs or medical treatment is obtained, incarceration results.

(2) Increased Intra-abdominal Pressure.—If the uterus is so displaced that it lies on the floor of Douglas's pouch, the entire intra-abdominal pressure is acting upon its upper surface, and preventing it from returning to its proper position. If the intra-abdominal pressure is normal, the growing uterus is usually able to make its way out of the pelvis against it; but, if it is unduly increased, the uterus may be unable to do so. Consequently, all such conditions as extreme flatulence, abdominal tumours, and habitual overdistension of the bladder favour the occurrence of incarceration.

(3) Peritoneal Adhesions.—If the fundus is firmly adherent to

the peritoneum of Douglas's pouch, it cannot rise. In such cases, abortion is the most usual termination of the case, and, if this does not occur, incarceration results, save in the small proportion of cases in which the termination to which we shall next refer—*i.e.*, anterior development—results. Similarly, if the pelvic cavity is roofed over by adherent intestines, it may be impossible for the displaced uterus to rise. Such a cause of incarceration is, however, perhaps more hypothetical than actual.

Symptoms.—The symptoms of an incarcerated retro-deviated uterus will be readily understood, if the anatomical changes which result from the condition are noted (*v.* Fig. 277). Instead of the growing uterus rising out of the pelvis and pressing less each day on the pelvic contents, as is normally the case, the pelvic cavity is occupied by a gradually enlarging tumour, which presses in all directions. The resultant symptoms are due to pressure upon the pelvic contents, and become progressively more severe each day. The subjective symptoms are pain, referred to the lower part of the back, and running down the thighs, from pressure upon the pelvic nerves; constipation, with sometimes rectal tenesmus, from pressure upon the rectum; difficulty in micturition from pressure upon the urethra; and, finally, complete retention of urine, passing in turn to incontinence, the result of overdistension of the bladder (ischuria paradoxa). The objective symptoms are also the result of the growing tumour in the pelvis. On making a vaginal examination, the vagina is found to be displaced forwards by the pressure of an elastic tumour, which fills Douglas's pouch and presses the pelvic floor downwards. The vagina is longer than usual, and considerable difficulty is found in reaching the cervix, which, in addition to being displaced upwards, is also pushed forwards above the symphysis. If a finger is passed into the rectum, the latter is found to be flattened out against the posterior pelvic wall. If the bladder is overdistended, a tumour will be found on palpation of the abdomen, corresponding as a rule in size and position to a five to seven months' pregnant uterus. It is, however, more elastic than a uterus would be, and no fœtal parts can be felt nor fœtal heart heard. This tumour is formed by the distended bladder, and varies in size according to the time retention has lasted. The position of the urethral orifice will be found to be displaced upwards, so that it is with difficulty that a catheter can be passed into it. This is in part due to the dragging upwards of the anterior vaginal wall owing to the displacement of the cervix and the consequent traction upon the cervico-vaginal junction, and in part to the distension of the bladder dragging the urethra itself upwards. It is impossible to make a bi-manual examination until the bladder is emptied. When this has been done, the upper limits of the pelvic tumour can be mapped out, and its continuity with the cervix and identity with the uterus established.

As a consequence of the overdistension of the bladder and the prolonged retention of urine, so great a degree of interference with the nutrition of the bladder-wall may result that portions of the mucous membrane may be shed in flakes, and in some cases

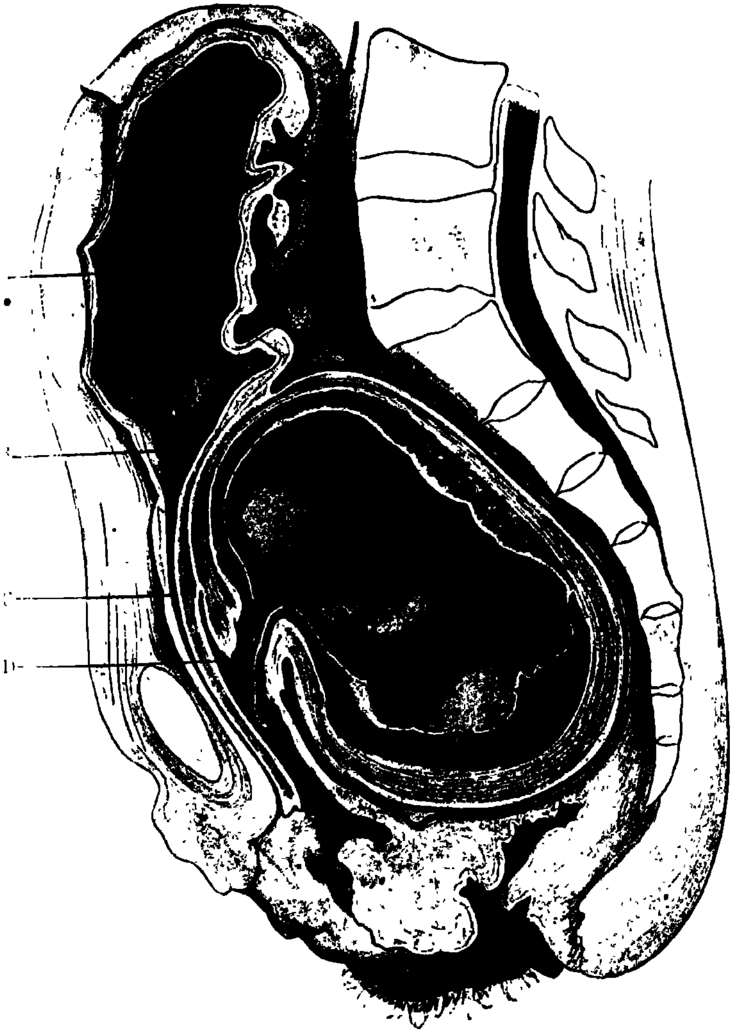

FIG. 277.—INCARCERATION OF A RETRO-FLEXED PREGNANT UTERUS. A, Bladder ; B, neck of bladder ; C, urethra ; D, cervix. (Wyder-Schwyzer.)

even the entire mucous membrane be thrown off. Subsequently, bacteria may pass from the intestines into the bladder, and decomposition of the urine and of the shed mucous membrane result, conditions which may in turn lead to a general septic peritonitis, or rupture or sloughing through of the bladder-wall may occur. If rupture occurs, the laceration is said to be usually found on the posterior wall and near the fundus (Winckel*). In cases of rupture of the anterior wall, extravasation of urine into the tissues of the abdominal wall and surrounding parts may take place, if the seat of the rupture is below the line of peritoneal reflexion. In consequence of the increase of tension in the bladder, dilatation of the ureters and of the pelvis of the kidneys usually results, and septic changes in the bladder may extend to the ureters and kidneys, leading to the occurrence of pyelonephrosis, and finally, perhaps—if the patient lives long enough—to uræmic poisoning from suppression of urine.

The wall of the uterus may in exceptional cases become gangrenous in one or more places, owing to the pressure to which it is subjected, with the result that an opening may form between the uterus and the rectum, or through the posterior vaginal wall.

Diagnosis.—As a rule, the diagnosis of incarceration of the uterus is not difficult, if the possibility of its occurrence is present in the mind of the examiner. On the other hand, errors have frequently been made because the possibility of its occurrence has been overlooked. The two errors which are most usually made are, first, mistaking the distended bladder for a pregnant uterus, and, secondly, mistaking the retro-deviated uterus for a tumour in Douglas's pouch. The former error should never be made, as it can always be avoided if the case is approached with an open mind, and if the history of the patient has been obtained with due care. It is a cardinal rule in all cases of abdominal enlargement to ascertain that the bladder is empty, and in cases of doubt to pass a catheter. If this rule is followed, either the bladder will be emptied and the tumour will disappear, or the impossibility of passing a catheter will immediately suggest the nature of the case. The second error is more difficult to avoid; indeed, in some cases it will be impossible to say what is the exact nature of the pelvic tumour save by carefully examining the patient under an anæsthetic. There are three conditions which may be readily confounded with incarceration of the pregnant uterus. These are a myomatous uterus or an ovarian cyst impacted in the pelvis,c or a retro-uterine hæmatocele. a In a myomatous uterus, the history shows that instead of a period of amenorrhœa, the patient complains of menorrhagia, and that the other subjective and objective symptoms of pregnancy are absent. The uterus is firmer than a pregnant uterus would be, and is usually somewhat irregular in outline. b In the case of an ovarian cyst, the uterus can be found anteposed to the tumour in Douglas's pouch. The history of the case is also opposed to the idea of pregnancy, and the subjective and objective symptoms are wanting. [c] A retro-uterine hæmatocele is the most likely to be a source of error, inasmuch as it is usually the result of pregnancy, and as in consistency it sometimes resembles a pregnant uterus. The most important points of difference are the absence of any displacement of the orifice of the urethra—as a hæmatocele in Douglas's pouch will not cause any upward traction on the anterior vaginal wall, and the fact that the uterus can be found on careful bi-manual examination anteposed to the pelvic tumour. Further, retention of urine rarely occurs in the case of a hæmatocele, and a history of the sudden onset of pain, followed by collapse—*i.e.*, the history of the rupture of an extra-uterine pregnancy—is usually forthcoming. A correct diagnosis in these cases is of the greatest importance, as the dangers which result from a mistake are very great. An incarcerated uterus must be replaced, if possible, but the 'reposition' of a hæmatocele, which, perhaps, was undergoing decomposition, might be attended by fatal consequences, as will be readily understood. The importance of the upward displacement of the orifice of the urethra as a distinguishing sign which is alone found in the case of an incarcerated gravid uterus was pointed out by Roper during a discussion at the London Obstetrical Society in 1874. Its occurrence is due to the attachments of the pelvic tumour to the vagina at the cervico-vaginal junction, and, though eminently characteristic of an incarcerated pregnant uterus, it may also occur in cases of uterine enlargement from other causes, such as myomata.

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* *Op. cit.*, p. 237.

Treatment.—The treatment of incarceration may be summarised in a few words. The bladder must be emptied, and the uterus replaced, if possible without interfering with the course of pregnancy. If this is impossible, the uterus must be first emptied, and then replaced.

The difficulties in the way of carrying out the first step of this procedure—*i.e.*, the emptying of the bladder—have been already referred to, as well as the manœuvres by which they may be overcome. If all attempts at the passage of a catheter fail, the bladder must be punctured supra-pubically, and thus emptied.

As soon as the bladder is emptied, the reposition of the uterus is attempted. At first, we endeavour to do this in the ordinary manner—*i.e.*, by upward pressure upon the fundus in the axis of the pelvis, with two fingers in the vagina, and the patient in the dorsal position. If this fails, as will probably be the case, one or two fingers are introduced into the rectum and pressure made upon the fundus. In the ordinary run of cases, reposition will be thus accomplished, especially if the patient is first placed under an anæsthetic. The importance of pushing the fundus to one or other side of the promontory so as to get clear of this projection, and thus gain more room, was first pointed out by

Skinner,* and is insisted upon by Barnes.† It is a very essential line of procedure in cases of flattened pelvis, but in the case of a normal pelvis, we doubt that much advantage is gained by adopting such a course, while, if the uterus fills the pelvis, it is impossible. If our efforts at reposition are still unsuccessful, a further attempt may be made with the patient in the knee-chest position. This position undoubtedly favours reposition, but the difficulty of maintaining a patient in it and at the same time administering an anæsthetic are very considerable, unless we have special apparatus at hand or numerous assistants, and if a choice has to be made between the knee-chest position and anæsthesia, we prefer the latter.

Cases have been recorded in which reposition has been obtained by the use of a colpeurynter‡ (Playfair), and by the insertion of a watch-spring pessary (Japp Sinclair). Moreover, cases have been recorded in which reposition occurred spontaneously after manual efforts had failed. We confess, however, that we are very sceptical as to success attending such measures in cases where previous manual attempts had been regularly and properly carried out under anæsthesia, and had failed. The failure of attempts at reposition made with the patient in the side position and without the administration of an anæsthetic do not, however, prove that the displacement is irreducible, and we fancy that it is in such cases that hydrostatic dilators and such like procedures have succeeded. It is possible that the use of Walcher's position might be of value, on account of the increase in the width of the conjugate diameter which it causes.

If the uterus cannot be replaced, it must be emptied. The best method of doing so consists in inducing abortion, but here again difficulties are met with. The readiest means of inducing abortion consists in puncturing the membranes with a sound or stylette introduced through the cervical canal. But, on account of the upward displacement of the cervix, it is almost impossible to get the sound into the cervical canal, or if we succeed in doing this, to then pass it onwards into the uterus, on account of the downward bend of the axis of the uterine cavity. An ingenious method of passing a stylette has been suggested and successfully practised. It consists in cutting the ends off a metal male catheter, in such a manner as to leave a straight portion of sufficient length to reach from the vulva to the cervical orifice, and enough of the curved portion to reach from the external to the internal os. The angle of the curve may be slightly accentuated by bending until it is adjusted to the angle which the cervical canal makes with the vagina. The catheter is then slipped up into the vagina and guided with the finger up to the ervical orifice, into which the curved end is slipped. A stylette ade of soft metal is then pushed along the catheter by which it guided into the internal os. It is then cautiously passed through he latter, and the membranes punctured. If we fail to puncture he membranes even by this means, a fine trochar and canula ust be passed through the posterior vaginal wall into the uterus nd the liquor amnii drawn off. If proper aseptic precautions re taken there is no danger in such a procedure, and it will effect uch a reduction in the size of the uterus that reposition may be ossible. Then if contractions do not occur and expel the ovum, he cervix must be dilated and the latter removed.

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* *Brit. Med. Journ.*, 1860.

† 'Obstetric Operations,' third edition, p. 276.

‡ A pear-shaped rubber bag which is introduced into the vagina and filled with water. It exercises a gentle and continuous pressure upon the surrounding parts.

As soon as the uterus has been replaced, a Smith-Hodge pessary f a suitable size is inserted in order to maintain it in position. If regnancy continues, the pessary should be left in until the end f the fourth month, when it may be removed, as the uterus will then be too large to again become displaced.

Prognosis.—The prognosis of these cases is good if the condition is recognised before any pressure necrosis of the uterus or surrounding parts, or any sloughing of the bladder wall has occurred, and if reposition is possible. Once either of these complications have occurred the prognosis becomes serious, in accordance with the extent to which the necrosis or sloughing have gone. If an incarcerated uterus remains untreated and abortion does not occur, the most favourable termination that can be hoped for is the escape of the contents of the uterus through an opening, the result of sloughing, between the uterus and the vagina or rectum.

Anterior Development.—The rarest of all the terminations of backward displacement of the pregnant uterus is that known as anterior development of the uterine wall. In this condition, the posterior wall of the uterus, which is in contact with the floor of Douglas's pouch, is kept in that position either by adhesions or by an overhanging promontory, while, at the same time, sufficient development of the anterior uterine wall takes place to allow room for the growing fœtus. The result of this is that at the end of pregnancy the cervix is situated higher than normal, and is pushed forwards above the symphysis. The main part of the uterus is found in its normal position, but behind the vagina and below the cervix is found a uterine pouch which fills Douglas's pouch. To this condition, the terms sacculation of the uterus and partial retroversion have also been applied. It is analogous to a somewhat similar condition to which we shall presently refer, in which a uterine pouch is found anterior to the cervix.

Symptoms.—In the early months, the symptoms are akin to those of incarceration, but, as anterior development of the uterine wall takes place, they pass off and no further symptoms occur until labour commences. Then, on examining the patient, the presence of the pelvic pouch containing the lower pole of the fœtus is discovered, as well as the high situation of the uterine orifice. The effects of the condition upon the mechanism of labour depend upon the size of the pelvic pouch. If the latter is large and allows the lower pole of the fœtus to descend into it, it is obvious that delivery will be most difficult, as the presenting fœtal pole will be unable to enter the uterine orifice, and consequently there will be no presenting part to dilate the uterine orifice. Further, all manipulation with the object of delivering the fœtus will be most difficult, on account of the compression of the vagina between the symphysis and whatever part of the fœtus is found in the pelvic pouch.

Diagnosis.—The diagnosis of the condition is readily made. Possibly, confusion may arise between it and an ovarian cyst which has descended into the pelvis below the presenting part. It will, however, be easy to determine that, in the latter case, the fluid in the pelvic tumour is not continuous with the fluid in the uterus, and also that the pelvic tumour does not contain a fœtal part.

Treatment.—The treatment of these cases more correctly belongs to the pathology of labour, but, inasmuch as such a course would necessitate separating them from incarceration of the uterus, we prefer to discuss them here. Barnes succeeded in pushing up the pelvic pouch and bringing down the cervix, and then delivering the fœtus by the forceps, or by turning it into a breech presentation, drawing down a leg, and applying traction to the latter—the necessary dilatation of the cervix in either case having been first obtained by the use of hydrostatic dilators. If such a course is possible it is the most suitable one to adopt. If, however, the pelvic pouch cannot be replaced, nor sufficient dilatation of the cervix obtained to enable version and extraction to be performed, the only alternative is Cæsarean section. If this operation is necessary, it may be carried out either by the abdominal route, or by the vaginal route as recommended by Dührssen. The latter route seems to offer certain advantages in these cases, on account of the close approximation of the uterine and posterior vaginal walls.

FORWARD DISPLACEMENTS.—The normal position of the non-pregnant uterus is one of complete anteversion and slight anteflexion. In consequence, it lies almost horizontally in the pelvis when the bladder is empty, its anterior or lower surface in contact with the latter organ, and the tip of the cervix on a level with the lines joining the ischiatic spines. As pregnancy advances, the fundus rises upwards, and by the fourth month the previous anteversion has almost or entirely disappeared. Later, a slight degree of anteversion reappears owing to the falling forward of the uterus against the abdominal walls. The exact degree depends upon the laxity and strength of the abdominal walls.

Two forms of forward displacement may occur during pregnancy :—A pathological degree of anteflexion and a pathological degree of anteversion.

Pathological Anteflexion.—The normal anteflexion of the uterus is due to the fact that the weight of the uterine body causes the latter to fall downwards until it meets with the support of the bladder. As soon as any upward force, such as the pressure of the distending bladder, begins to make itself felt, the body is pushed up and the anteflexion disappears. In pathological anteflexion, the body of the uterus makes a sharper angle with the cervix than is normal, and at the same time, owing to the rigidity of the uterine tissue or to other causes, such as the fixation of the body by adhesions, upward movement of the body as the bladder fills does not occur.

Ætiology.—This condition may result from three causes :—

(1) Congenital Mal-development of the Uterus.—In such cases, either pregnancy does not occur at all owing to an accompanying undeveloped condition of the ovaries, or if it does the displacement of the uterus disappears as the latter organ enlarges. Consequently, the obstetrical importance of such cases is nil.

(2) The Result of Inflammation.—Pelvic peritonitis resulting in the formation of adhesions between the isthmus of the uterus and the sacrum, and resulting in the dragging backwards of the isthmus while leaving the fundus free, is a common cause of pathological anteflexion in the non-pregnant state. As, however, the fundus is free, such cases do not possess any great obstetrical interest. More rarely, pelvic peritonitis may result in the formation of adhesions between the fundus and the peritoneum covering the bladder. In such cases, the fundus is not free to rise during pregnancy, and, consequently, complications may occur.

(3) The Result of Operative Interference.—In the operation known as vaginal fixation of the uterus for the cure of backward displacements, it was at one time customary to suture the fundus of the uterus to the anterior vaginal wall. Such a procedure resulted in the production of an extreme degree of fixed anteflexion, and interfered with the rising of the uterus during pregnancy, with the result that serious complications resulted during pregnancy and labour. It is, moreover, an unnecessary operation, as the same results can be obtained by suturing, not the fundus, but a point a little above the isthmus to the vaginal wall, and in this way bringing the uterus into a more correct position.

Symptoms.—When the fundus of the uterus is fixed in a position of anteflexion, its development during pregnancy is interfered with. In consequence, in some cases, abortion results, while, in other cases, a posterior development of the body takes place analogous to the anterior development, which has been described as occurring when the fundus is fixed in Douglas's pouch, while a pouch or anterior sacculation persists between the cervix and the symphysis. As the posterior wall develops to accommodate the growing fœtus, the cervix becomes drawn upwards and backwards, until finally it lies high up in the hollow of the sacrum, where it is difficult or impossible to reach it with the fingers.

This condition produces few symptoms during pregnancy. There may possibly be some interference with the distension of the bladder, with resultant frequent micturition. When, however, the patient comes into labour, difficulties may result similar to those which have been described when discussing the analogous condition of posterior sacculation. The presenting pole of the fœtus descends into the anterior pouch, and, consequently, both the dilatation of the os and the passage of the fœtus out of the uterus are interfered with. If such a case is examined vaginally, the presenting part covered by uterine wall is found in the pelvis, and pushes the vagina downwards and backwards. It may be possible to pass the finger above it and so to reach the cervix, but, on the other hand, if the presenting part has descended deeply and fills the pelvis, such a course may be impossible.

Diagnosis.—The only condition for which anterior sacculation of the uterus can be mistaken is the rather problematical one of complete acquired occlusion of the uterine orifice, as in both conditions the cervix fails to dilate. Here, however, the resemblance ceases, as in acquired occlusion of the orifice some trace of cervix can be found in its normal position, while in anterior sacculation of the uterus the cervix is drawn upwards and backwards.

Treatment.—In some cases, where the presenting part is not fixed, it may be possible to push up the anterior pouch, as has been done in the case of a posterior pouch, and to draw down the cervix. If this can be done, the pouch can be then maintained in position by a firm vaginal tampon, until such time as the cervical canal is sufficiently dilated to permit of the passage of the presenting part. If it cannot be done, an attempt must be made to dilate the cervix with hydrostatic dilators, and, as soon as a sufficient degree of dilatation has been obtained, podalic version should be performed and a leg drawn down. If the anterior pouch is of small size, and the uterine orifice already partially dilated, it may be possible to draw down the cervix below the presenting part by hooking one or two fingers into the orifice. Each contraction of the uterus then drives the presenting part more deeply into the orifice, and, finally, the cervix will retract upwards over the presenting part. If, on the other hand, the anterior pouch is so deep, and the displacement of the cervix so marked that it is impossible to reach the latter, a choice must be made between abdominal or vaginal Cæsarean section. As a rule, perhaps, the latter operation will be more easily performed. These cases are, however, of such extreme rarity, that it is difficult to lay down a definite rule for treating them.

Prognosis.—If the condition is not relieved, and labour is allowed to continue, it is possible that, in some cases, the retraction of the uterus may result in drawing up the cervix over the presenting part, and so causing the anterior pouch to disappear. On the other hand, if this does not happen, the uterus will almost certainly rupture, and the fœtus be expelled through a rent in the floor of the pouch. Consequently, in all such cases the course of labour must be carefully watched. If the case is correctly treated, there is no reason that both mother and fœtus should not be saved.

Pathological Anteversion.—A pathological degree of anteversion is said to exist when the normal anteversion is exaggerated or is permanent, so that the uterus cannot be pushed upwards by the distension of the bladder, and when the rigidity of the uterine tissue is so increased that the normal degree of flexion cannot occur. In pregnancy, pathological anteversion can scarcely be considered to occur before the uterus has passed out of the pelvis, and then it consists in an excessive forward inclination of the axis of the uterine body, so that the axis becomes horizontal, or even lies higher posteriorly than anteriorly. To this condition, the term 'pendulous abdomen' is also applied.

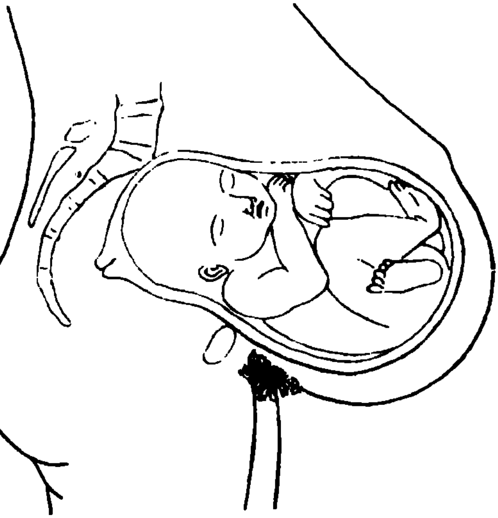

FIG. 278.—A PENDULOUS ABDOMEN.

Ætiology.—Pathological anteversion of the pregnant uterus, or pendulous abdomen, is the result of the abdominal walls failing to withstand the force with which the uterus presses against them. This condition may therefore result, either from the increased force with which the uterus presses against the walls, or from the diminished strength of the walls. The uterus presses with increased force against the abdominal wall in cases of contracted pelvis, owing to the fact that it is pushed upwards out of the pelvis by the narrow brim, and that in consequence it tends to fall forwards against the abdominal wall; in cases of multiple pregnancy and tumours, owing to the increased size of the uterus; and in marked lordosis, owing to the forward displacement of the uterus. The normal tone or resistance of the abdominal walls is diminished as a result of previous overdistension, as in the case of previous multiple pregnancies, hydramnios, or multiparity; of the yielding of the cicatrix of an abdominal incision; and sometimes as the result of muscular wasting or insufficient development, the result of mal-nutrition, or long-continued illness.

Symptoms.—If the uterus is fixed in a position of anteversion, it may give rise to slight irritability of the bladder during the first three months. Later, as the more important anteversion of pregnancy occurs, the patient finds it difficult to walk owing to the alteration in the position of her centre of gravity. At the same time, the stretching of the skin gives rise to pain, excoriations occur as the result of the rubbing together and moisture of the skin, œdema of the abdominal walls results from the dependent position, and constipation and difficulty of defæcation from the lessened intra-abdominal pressure. The appearance of the patient is characteristic, especially when she stands upright. If the recti muscles are widely separated, the uterus may project through them, causing a more or less conical tumour. To this condition, the term 'eventration' is applied.

The effects of a pendulous abdomen on labour are numerous and important. Anomalies in the lie and presentation of the fœtus are of common occurrence owing to the altered position of the uterus, the loss of the support which the presenting head normally receives from the pelvic brim, and the alteration in the relation between the axis of the uterus and the axis of the pelvic brim. The course of labour is also prolonged, owing to the failure of the voluntary contractions of the abdominal muscles, and to the slow engagement of the head, which is driven against, instead of into, the pelvic brim.

Treatment.—In all cases in which the abdominal walls are lax, the patient should wear a properly fitting abdominal belt during pregnancy. Due attention to this precaution will prevent the increased laxity of the walls, which will otherwise result from each successive pregnancy. Indeed, we consider that it is advisable for every pregnant woman to wear a proper abdominal support, at any rate during the last three months of pregnancy, as a prophylactic measure, unless the development of the abdominal muscles is exceptionally well marked. The patient should remain in bed during the entire period of labour, and should lie as much as possible upon her back. At the same time, an abdominal binder must be pinned tightly round the abdomen in such a manner as to bring the axis of the uterus as nearly as possible into correspondence with the axis of the pelvic brim. All complications of presentation, etc., must of course be corrected.

DOWNWARD DISPLACEMENTS.—Under the head of downward displacements we shall discuss three conditions which are closely associated with one another. These are:—Prolapse and procidentia of the uterus; prolapse of the vaginal walls; hypertrophy of the cervix.

Prolapse and Procidentia of the Uterus.—A uterus is said to be prolapsed when it has descended into the vagina; procidentia of the uterus, on the other hand, is the term applied to the condition when the uterus has in part or altogether passed outside the vulva. Pregnancy has relatively frequently occurred in prolapse, and cases of its occurrence in procidentia have also been recorded. In the older writers, cases have been recorded in which, at full term, a pregnant uterus has been found completely outside the pelvic cavity, but such cases are rightly regarded as imaginary. If pregnancy occurs in a case of complete procidentia, either abortion results or the patient seeks medical aid and the uterus is replaced.

Spiegelberg stated that when pregnancy occurs in a case of downward displacement of the uterus three courses are possible:—

(1) As the uterus increases in size, it rises and the prolapse disappears. This is, perhaps, the most common termination. If the prolapse was associated with hypertrophy of the cervix, the latter may still protrude through the vulva, accompanied or not by prolapse of the vagina.

(2) The uterus may develop in the pelvic cavity, and become incarcerated there, leading to the occurrence of similar results and consequences to those already enumerated under the head of incarcerated retroverted uterus, and causing the death of the mother if abortion does not take place or if the uterus is not replaced.

(3) A great part of the prolapsed uterus passes entirely outside the pelvis, the ovum remaining in the part which is still inside the pelvis. In such cases, unless artificial or spontaneous reposition occurs, abortion or incarceration of the part of the uterus which contains the ovum will result.

To these three terminations a fourth may be added. The pregnant uterus may remain wholly outside the vulva until the third or fourth month. Then either abortion occurs or the uterus becomes strangulated and sloughs.

Symptoms.—If pregnancy occurs in a prolapsed uterus all the symptoms ordinarily produced by prolapse will be accentuated. If the cervix is outside the vulva, its ulceration is almost certain to occur, while the exposure to the air and the constant friction against the skin and clothes of the patient will lead to alterations in its consistency which may have serious consequences during labour. They will be referred to presently.

Treatment.—A prolapsed uterus must be immediately replaced, and maintained in position either by the use of frequently changed tampons or the insertion of a suitable ring or Smith-Hodge pessary. If reposition is impossible owing to the size of the uterus, abortion must be induced, and the uterus then replaced.

Prolapse of the Vaginal Walls.—This condition is almost invariably associated with a greater or less degree of prolapse, and may persist even after the prolapsed uterus has been replaced. In consequence of the exposure of the mucous membrane, important changes in the nutrition and nature of the latter may occur leading to ulceration and thickening. The importance of preventing either of these conditions from occurring is obvious, as it is a serious matter to have ulcerated and probably septic surfaces in so close proximity to the uterus during labour, while the thickening of the vaginal walls will prevent their dilatation during labour and lead to the occurrence of lacerations.

Treatment.—In most cases, the reposition of the uterus will lead to the reposition also of the vaginal walls. The mucous membrane of the latter must be then brought back to a normal condition by hot douches, and the use of vaginal tampons soaked in a ten per cent. solution of ichthyol in glycerine. When the vaginal walls prolapse even after the reposition of the uterus and the insertion of a pessary, they must be kept in place and protected from friction, etc., by a soft pad supported by a perinæal band.

Hypertrophy of the Cervix.—Hypertrophy of the cervix may be, and usually is, associated with prolapse of the uterus, or, on the other hand, it may exist alone as a congenital condition. If the hypertrophy is considerable, the cervix may protrude through the vulva. The importance of this condition lies in the fact that changes occur in the tissues of the cervix which render its dilatation during labour very slow. These changes are particularly marked in cases in which the cervix has passed outside the vulva, as there then is usually a chronic inflammation and induration of the muscle fibres. Moreover, ulceration of the exposed portion of the cervix usually occurs and may be accompanied by a purulent discharge. Smyly records a case* which occurred in the Rotunda Hospital, in which a patient was admitted at full term with a long-standing prolapse of the cervix. Labour ensued, and had not lasted for more than six hours when the uterus ruptured in consequence of the obstruction offered to the expulsion of the fœtus, with fatal results.

Treatment.—When hypertrophy of the cervix is detected during pregnancy, and particularly when the cervix has passed outside the vulva, every effort must be made to bring back the tissues as far as possible to their normal condition. If the uterus is prolapsed, it must be replaced and maintained in position by means of a pessary or a tampon. At the same time, attempts must be made to soften the tissues of the cervix and to cure any ulcerations present. For this purpose, tampons of cotton-wool soaked in glycerine and ichthyol are placed in the vagina. Hot vaginal douches may also be occasionally given, and hot hip-baths administered. If the cervix remains prolapsed outside the vulva, even after the uterus is replaced, or if there is a marked degree of hypertrophy, the question of operative measures with the

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* 'Report of the Rotunda Hospital,' 1890-91.

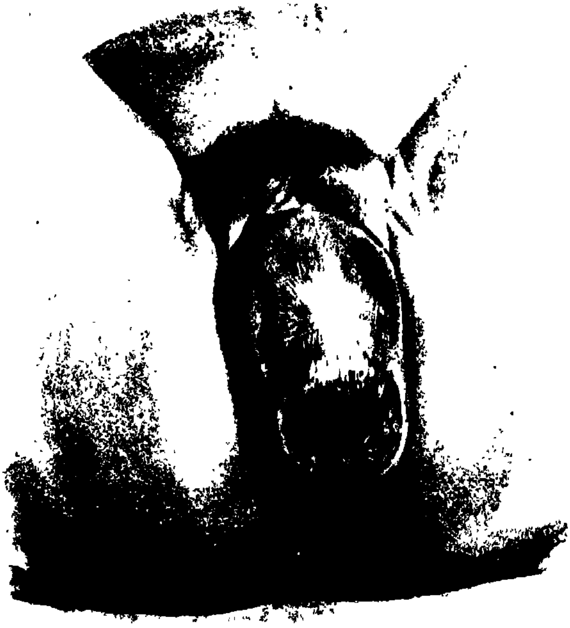

FIG. 279.—PROLAPSE OF THE HYPERTROPHIED CERVIX AT THE EIGHTH MONTH OF PREGNANCY. (Bumm.)

object of removing the redundant portion must be discussed. Winckel and Schroeder both agree in recommending such a course, at any rate during the early part of pregnancy. There can be little doubt that the chance of provoking abortion by a cervical amputation should not be allowed to influence us, if there is a probability of subsequent serious and dangerous interference with the mechanism of labour. If the uterus is otherwise healthy, there is no reason why the operation should not be successfully performed without inducing abortion.

If the condition is seen for the first time when the patient comes into labour, the progress of the case must be carefully watched. If dilatation does not proceed naturally, it may be necessary to attempt to dilate the cervix artificially by means of hydrostatic dilators. If an attempt to do so is unsuccessful, the cervix must be dilated by means of deep incisions, as recommended by Dührssen, or it may possibly in rare cases be necessary to perform Cæsarean section. It is unlikely that Bossi's or Frömmer's dilator would be of use in these cases, owing to the alterations in the cervical tissues.

HERNIA OF THE PREGNANT UTERUS

'Hernia of the pregnant uterus is an extremely rare condition, so much so that up to 1885 only seven cases of inguinal hernia were recorded in medical literature (Eisenhart[*]), about three cases of umbilical hernia, and one of femoral hernia.'[†]

Ætiology.—An inguinal hernia will in all probability be caused by the appendages on one side passing into the sac of a pre-existing inguinal hernia and becoming adherent there, the uterus being dragged after them as the hernia enlarges. Winckel states[‡] that a congenital form of hernia of the uterus or of a uterus bi-cornis or unicornis may occur. He explains this by comparison with the descent of the testicle in the male. 'If the ovary descends along the round ligament, as does its analogue the testicle, along the gubernaculum Hunteri, and if, as in the male fœtus, even a short processus vaginalis of peritoneum passes into the inguinal canal, then the ovary, though it has not yet passed through the inguinal canal, is disposed to enter an inguinal hernia if the latter develops later on, and the uterus or the corresponding uterine horn follows the shortened round ligament.'

The uterus can only enter an umbilical hernia when it has sufficiently developed to reach the opening into the sac. Kennedy[§] records a case in which the entire uterus passed into such a hernia, and was found outside the abdominal cavity hanging down to the knees.

Diagnosis.—The diagnosis will be made from the history of the patient, from the absence of the uterus from its proper position, and by tracing the connection between the tumour contained in the hernia and the cervix.

Treatment.—The condition must in all cases be relieved as soon as it is recognised, as the farther pregnancy advances the more difficult it will be to do so. If the case is seen while the uterus is still small, it may be possible to reduce the latter by cutting down on the ring, and if necessary enlarging it. The opening should then be closed by one of the recognised operations for the radical cure of hernia. If the uterus is too large to offer a hope of reduction, but the fœtus is not too large to pass through the opening, abortion may be induced. If pregnancy is too far advanced to permit even of this course, it will be necessary to cut down upon the uterus and perform Cæsarean section. If the uterus cannot then be reduced, it ought to be removed. It ought to be possible to replace the uterus in almost every case in which it is found in an umbilical hernia.

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[*] 'Ein fall von hernia inguinalis,' etc., I.-D., Leipzig, 1885.

[†] Spiegelberg, 'Text-book of Midwifery,' Sydenham Society's edition, vol. i, p. 381.

[‡] *Op. cit.*, p. 246.

[§] 'Obstetrical Auscultation,' p. 40.

MALFORMATIONS OF THE UTERUS OR VAGINA

The various malformations of the uterus which arise as a result of developmental errors are occasionally of interest to the obstetrician, as in certain forms they may give rise to complications during pregnancy or labour. The nature and origin of these malformations will be best explained by a brief reference to the development of the uterus.

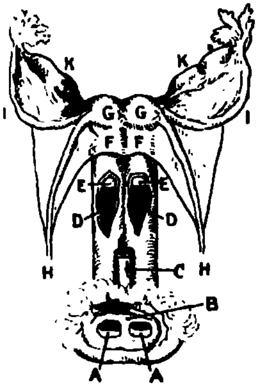

Fig. 280.—Double Uterus and Vagina.

A, Vulva; B, urethral orifice; C, urethra; D, vagina; E, cervix; F, anterior reflexion of peritoneum; G, fundus; H, round ligament; I, Fallopian tube; K, ovary. (Courty.)

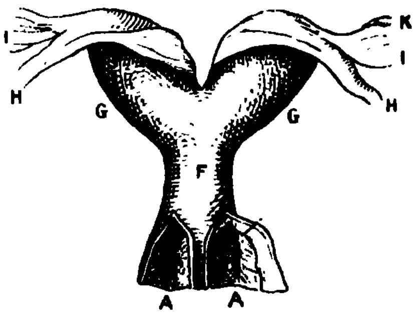

Fig. 281.—Uterus Bi-cornis, with Double Vagina.

A, Vagina; F, cervix; G, fundus; H, round ligament; I, Fallopian tube; K, ovary. (Schrœder.)

In the early embryo, the female reproductive system is represented by two ducts, which lie at each side of the spine. At about the eighth week, the lower two-thirds of these ducts con-join, the septum between them disappears, and they form a single tube. The upper third of the ducts remain distinct. From the lower half of the united ducts is formed the vagina, and from the upper half the uterus, while from the upper third of the ducts—the un-united portion—are formed the Fallopian tubes. Thus, each Fallopian tube, and its corresponding half of the uterus and vagina, were once a single tube. This being so, we may expect to find errors of development, the results of non-fusion or of incomplete fusion of the ducts, of insufficient development of one or both ducts, and of other anomalies which are not of importance from an obstetrical point of view.

The principal errors of development with which we are here concerned are as follows:—

(1) The tubes may remain separate through their entire extent,

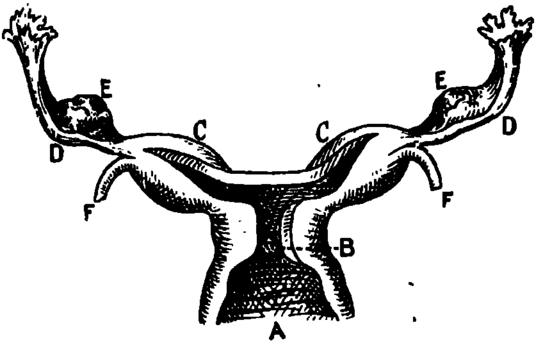

FIG. 282.—UTERUS BICORNIS, WITH SINGLE VAGINA.
A, Vagina; B, cervix; C, fundus; D, Fallopian tube; E, ovary; F, round ligament.

and thus a double uterus and vagina result—uterus duplex separatus or uterus didelphys and vagina duplex (*v.* Fig. 280).

(2) The tubes may only coalesce in the lower third. In consequence there is a double uterus—uterus duplex separatus or uterus didelphys—with a single vagina, in which the septum between the two tubes may or may not persist.

(3) The tubes may remain separate until the level of the cervix is reached, below which they coalesce, and a uterus bi-cornis result (*v.* Figs. 281 and 282). The septum may or may not persist in the united portion and in the vagina. If the junction of the tubes takes place higher in the uterus, the double character is merely shown by a depression or notch in the fundus. To this condition the term uterus cordiformis is applied.

(4) The tubes may completely unite, but a septum persist in either the uterus or vagina, or in both. When it persists in the uterus, a uterus septus bi-locularis results, when in the vagina, a vagina septa (*v.* Fig. 283).

(5) Only one Müllerian duct may develop, the other remaining rudimentary, and a uterus unicornis result (*v.* Fig. 284).

Symptoms.—In the following account of the symptoms and effect of the various uterine malformations, we have drawn largely from Spiegelberg's[*] writings on the subject.

Pregnancy has never been recorded in the case of a uterus didelphys.[2] In the case of a uterus bi-cornis with a single vagina, twins are not of uncommon occurrence, though, if the vagina is double, they are rare. Pregnancy is as a rule uninterrupted and delivery occurs at full term. When only one horn is impregnated, the other shares to a considerable extent in the hypertrophy of the pregnant side, and a decidua forms in it which is expelled after delivery. If the vagina is double, and one half is rudimentary and occluded, pregnancy on one side may coexist with a hæmatometra on the other. In such cases, abortion as a rule occurs. During labour, complications may occur owing to the axis of the pregnant horn deviating from the axis of the pelvic brim, or to the unimpregnated horn offering an obstruction to the descent of the fœtus into the pelvis, or to the deficient muscular development of the pregnant horn. In some cases, the unimpregnated horn may be drawn up above the brim during labour, *pari passu* with the progress of retraction, as sometimes occurs in the case of a myoma. If this occurs, it will be palpable as a small conical tumour lying to one or other side of the uterus. When pregnancy occurs in both horns, labour may come on at a different time in each, according to the date at which impregnation took place. Cases such as this have given rise to the idea of

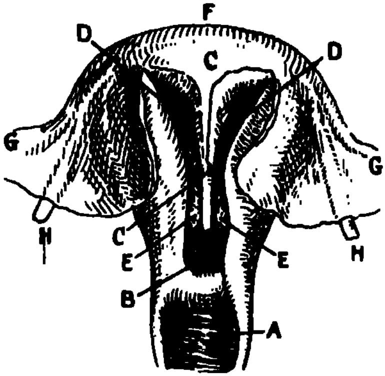

FIG. 283.—UTERUS SEPTUS BI-LOCULARIS.

A, Vagina; B, cavity of cervix; C, septum; D, uterine cavity; E, junction of uterine cavity and cervix; F, fundus; G, Fallopian tube; H, round ligament.

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[*] *Op. cit.*, p. 374.

superfœtation. When pregnancy occurs in one side of a uterus septus, delivery is as a rule slow owing to deficient muscular development. If the placenta is attached to the septum, severe post-partum hæmorrhage may occur, owing to the paucity of muscular fibres in the placental site. A septum in the vagina is in most cases pushed to one side during delivery. Sometimes, however, it may obstruct the descent of the presenting part, or, in the case of a pelvic presentation, a leg may descend at each side of it, and the fœtus thus get astride of it. If pregnancy occurs in the undeveloped horn of a two-horned uterus, the course is identical with that of a tubal pregnancy.

Diagnosis.—Many cases of uterine malformation escape notice altogether, as they do not give rise to any symptoms, and, consequently, the examination necessary to determine their presence is not made. A uterus bi-cornis may be recognised by abdominal palpation, when pregnancy has occurred in both horns and is some way advanced. There is a characteristic furrow running down the middle of the abdomen between the two horns, and, if a contraction is produced by external friction, the shape and outlines of each horn become more distinct. The relations of the round ligament to each horn can also be sometimes determined. The existence of a second non-pregnant horn may be determined by a careful bi-manual examination during the early months; later it is more difficult to recognise, as it probably lies posteriorly to the impregnated horn. During labour, it may again be possible to recognise it if it is drawn above the brim. A vaginal septum can, as a rule, be readily recognised, if an examination is made before the presenting part has descended into the vagina.

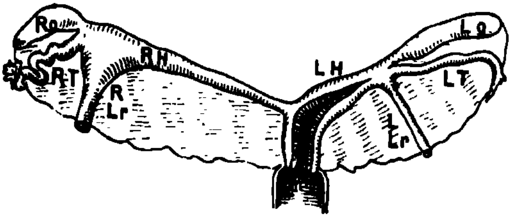

FIG. 284.—UTERUS UNICORNIS.

LH, Developed left horn; RH, non-developed right horn; RT, LT, right and left tubes; RLr, LLr, right and left round ligaments; Ro, Lo, right and left ovaries.

Treatment.—The treatment which must be adopted in these cases depends on the nature of the complications to which the malformation gives rise. Resultant abnormal presentations must be corrected. Deficient expulsive force must be supplemented by the application of the forceps, or by version and extraction. Post-partum hæmorrhage must be checked if it occurs. Any intra-uterine manipulations which may be necessary must be performed with great care and gentleness, as, owing to the defective development of the uterus, rupture may be caused by a very slight degree of force. Vaginal septa must be divided if they offer any obstruction to delivery, or if it appears likely that they will be torn during delivery. Pregnancy occurring in a rudimentary horn must be treated exactly as if it was a tubal pregnancy, from which indeed it will probably only be distinguished either during or subsequent to the removal of the gestation sac.

INFLAMMATION OF THE VAGINA AND CERVIX

Vaginitis and endocervicitis are not uncommon occurrences during pregnancy. When they occur, they give rise to a more or less profuse leucorrhœa, with the other symptoms of vaginitis in the non-pregnant—burning sensations both in the vagina and on the vulva due to the leucorrhœa, pruritus, and, in the case of endocervicitis, a feeling of weight and pain in the pelvis.

Ætiology.—It is unnecessary here to enter into all the causes of vaginitis and endocervicitis, inasmuch as they are identical with the causes of that condition in the non-pregnant, and will be found in works on gynæcology. It is sufficient to say that, during pregnancy, the commonest causes are gonorrhœa, gaping of the vagina the result of former lacerations, and prolapse. Leucorrhœa, consisting of a purely mucous discharge, the result of hyperactivity of the cervical glands, and in all probability not associated with any bacterial invasion of the genital tract, may also occur as a consequence of the stimulation of the glands, the direct result of pregnancy.

Treatment.—Gonorrhœal vaginitis and endocervicitis can, if acute, only be treated with hot baths, compresses over the lower part of the abdomen, mild, unirritating douches of boric lotion or plain water, and, if the patient will submit to the introduction, tampons of cotton-wool soaked in glycerine and icthyol or protargol, or iodoform pencils may be passed into the vagina. As the acute stage passes off, applications of solution of nitrate of silver (ten per cent.), of formalin (half to four per cent.), or of protargol (one to five per cent.), may be applied to the vagina through a cylindrical speculum. In simple catarrhal vaginitis and endocervicitis, applications of pyroligneous acid (full strength), or of sulphate of copper (five per cent.), may be similarly applied. If the endocervicitis is marked, local applications of pure carbolic acid may be applied on a Playfair's probe to any erosions and to the mucous membrane of the canal, but the greatest care must be taken that the probe is not in any way forced into the canal or passed through the internal os. If the probe will not slip readily into the canal, it should not be used at all.

Prognosis.—Any form of septic or gonorrhœal vaginitis or endocervicitis is a serious matter at any time, and especially during pregnancy, as the uterus may readily be infected subsequent to delivery. Accordingly, such infections must always, when possible, be cured before the onset of labour.

TUMOURS OF THE UTERUS AND OVARIES

Tumours of the uterus or ovaries do not often interfere with the course of pregnancy, although they frequently give rise to difficulties during delivery. If a tumour reaches a large size it may interfere with the course of pregnancy in one or other of the following ways:—

(1) By pressing directly upon the uterus, it may cause the descent of the latter, and the protrusion of the cervix through the vulva. If the pressure it exerts is so great as to interfere with uterine development, abortion or miscarriage may result.

(2) By causing increased intra-abdominal pressure, it aggravates all disorders of pregnancy which are the result of increased intra-abdominal pressure. In this way, a marked degree of constipation, genital and crural varices, vomiting, urinary troubles, inability to walk, and general discomfort may result. More rarely, the increased pressure upon the ureters may give rise to partial or complete suppression of urine.

(3) By causing increased intra-thoracic pressure, it may give rise to palpitations of the heart, and if this condition is unrelieved, cardiac irregularity followed by cardiac failure may supervene.

Treatment.—The removal of uterine tumours may be indicated during pregnancy for three reasons:—

(1) Owing to the severity of the pressure symptoms to which they give rise.

(2) On account of their situation, to avoid their causing complications during delivery, if they can be removed without interfering with the uterus.

(3) If they are believed to be malignant, if they are undergoing septic or saprophytic degeneration, or if they become strangulated.

In the absence of any of these indications for immediate removal, we may wait for full term. The treatment to be then adopted depends upon the effect of the tumour upon the course of labour, and will be discussed in another place. Small pedunculated myomata which project into the vagina may, however, be removed when recognised, as there is little or no danger of provoking uterine contraction by so doing. Malignant disease of the uterus, as met with in pregnancy, probably always affects the cervix. In all such cases in which there is a possibility of removing the entire growth, total extirpation of the uterus should be performed as soon as ever the condition is recognised. If, however, complete removal of the growth is obviously impossible, pregnancy may be allowed to continue till full term, when, owing to the changes in the cervix, the result of the disease, Cæsarean section will probably be necessary. If the condition of the patient is such that there is little or no prospect of her living to full term, her wishes and those of her relations must guide us as to whether Cæsarean section is to be performed in the interests of the fœtus, if the latter is viable. In the early months of pregnancy, when the fœtus is still small enough to pass through the cancerous cervix, and when the patient or her friends refuse to allow a Cæsarean section at a later date, abortion should be induced, as there is apparently little doubt that the existence of pregnancy stimulates the growth of the tumour.

Ovarian tumours should, as a rule, be removed as soon as their existence is recognised, as the dangers of the operation are less than those arising from the presence of the tumour. If, however, the tumour is only recognised during or immediately prior to labour, its removal may be postponed until the completion of the puerperium, unless its position and nature are such as to prevent the expulsion of the fœtus. The management of these cases will be referred to subsequently. The dangers of ovariotomy are no greater during pregnancy than at any other time, and the risk of a consequent premature expulsion of the fœtus is not very great. It is usually stated that pregnancy continues after ovariotomy in over seventy per cent. of cases.

CHAPTER IV

SPECIFIC INFECTIOUS DISEASES IN PREGNANCY

General Observations—Diphtheria—Enteric Fever—Erysipelas—Influenza—Phthisis—Pneumonia—Relapsing Fever—Scarlatina—Small-pox—Typhus Fever. Syph.

The influence of pregnancy on the course of the infective fevers, and conversely the effect of the infective fevers on the course of pregnancy, have received but scant notice in English text-books of midwifery. They have received more attention from writers on general medicine or special articles on fevers, but even here the references are on the whole disjointed and fragmentary, so that it is extremely difficult to draw any general conclusions from writers on either of these two subjects.

It will be at once allowed that the complication of any infective fever with pregnancy must be viewed with considerable anxiety, both as to the effect of the disease on the course of the pregnancy. and to the effect of the pregnancy on the course of the primary disease, but, further than warning friends of the possible complications which may ensue, there is, with a few exceptions, little reason for raising intense alarm. It may be also definitely stated that the infective fevers, with the exception of diphtheria and erysipelas, are not necessarily associated with an increased danger of 'puerperal fever.' If a patient aborts or miscarries, and the primary fever is complicated by so-called 'puerperal fever,' with its local or general phenomena, the medical man may assure himself that he is dealing with septic infection, and must look for some cause on which to lay the blame other than the specific fever from which the patient suffered before the uterine sinuses were opened. It must, however, be remembered that in so far as several of the infective fevers are associated with catarrh of mucous membranes, and that the discharges from such a source may, and usually do, teem with pyogenic micro organisms, so far these diseases are associated with an increased risk of septic infection.

If it is possible to make any general deductions from our personal experience, they are as follows:—

(1) When fever attacks a patient during the early or the late months of pregnancy, the onset of labour is more likely to result than when the attack occurs in the middle months.

(2) Fevers, in which the temperature goes through sudden and great variations, are more likely to cause premature delivery than are those in which the temperature gradually attains a high range.

(3) The higher the range of temperature, the more likely is the occurrence of premature delivery.

(4) Where cyanosis is marked during the course of a fever, premature delivery is very liable to take place.

(5) The effects produced on the woman by the fever-poison, such as high temperature, delirium, cyanosis, etc., appear to be the cause of abortion, rather than the fever-poison itself. Many grave cases of even the most serious fevers have run their course without either causing premature delivery or the death of the child, and even where the former has occurred, a living child is most frequently born, though it is likely to succumb soon.

(6) The onset of labour during the course of a fever does not as a rule materially alter such course.

We shall now consider the different fevers *seriatim*.

DIPHTHERIA

Diphtheria is a disease of all ages and both sexes. One attack does not confer immunity against subsequent infection, nor does pregnancy appear to cause any obstacle to infection.

Effect on Pregnancy.—When diphtheria is recognised early and treated by its antitoxin, the course of the disease is cut short, and modified in such a manner that little danger to the pregnancy results. If not thus early treated, and if the case is a severe one, with high temperature and extreme prostration, there is great danger, that, apart from the risk to life from the primary disease, abortion or premature delivery may be brought about by the accompanying pyrexia. However, pyrexia, though frequently seen, is by no means a marked feature of diphtheria, and, on the contrary, the range of fever is usually moderate (100° to 101° F.).

On the whole, therefore, it may be said that diphtheria does not seriously threaten the course of pregnancy. If, however, labour occurs during, or soon after the disease, very serious consequences are liable to occur.

Diphtheria may be considered to be a 'putrid' disease, accompanied as it is by putrid ulceration and discharge from throat, mouth, and nose — a discharge not only carrying diphtheria bacilli, but swarming with all the ordinary septic and saprophytic organisms. This discharge, if brought in contact with any other mucous membrane, as, for instance, the conjunctiva or the vaginal or anal mucous membrane, can set up in it with the greatest readiness a diphtheritic, and, following that, an ordinary septic inflammation. It follows, therefore, that, if delivery occurs, there is a serious danger of puerperal infection, and this danger is necessarily greater if instrumental delivery has to be adopted.

A further danger is also present. Diphtheria is accompanied by extreme physical prostration, and especially by marked cardiac weakness. It is also very liable to be, and frequently is, followed by peripheral neuritis, which may cause various degrees of paresis or actual paralysis—either localised or widespread. Hence, the danger that, if delivery comes on during or soon after the disease, death may suddenly occur from the increased strain placed on an already prostrate system.

Treatment.—The indications for treatment are clear. Immediately on the recognition of diphtheria in a pregnant woman, she should receive an initial dose of 4,000 units of antitoxin, 2,000 units more should be given after twelve hours, and the latter dose repeated each subsequent twenty-four hours, until at least twenty-four hours have elapsed since the complete disappearance of membrane. She should be given all the nourishment she will take. There is no indication for cutting off solid food, but it must be light and easily digested. Stimulants may be given in small quantity—two ounces of whisky in the day will be sufficient in an ordinary case—to stimulate digestion and circulation, but if decided weakness is manifested this dose may be increased. Strychnine must be given by the mouth or hypodermically, if symptoms of cardiac failure appear. The function of the bowel must be regularly attended to. Needless to say, the most extreme cleanliness must be observed as regards the clothing, surroundings, and attendants of the patient, and every precaution be taken to prevent her from infecting herself by her hands. This danger should be explained to her, and she should be warned not to bring the hands into contact with the external genitals.

If it is seen that delivery is going to occur, it is necessary to have a separate obstetrical nurse for the management of the labour and the puerperium. This nurse must have nothing whatever to do with the general nursing, which must be left entirely to the medical nurse, who does nothing else.

Delivery should be left as far as possible to Nature, but, on the first sign of exhaustion, the forceps must be applied, and delivery effected as rapidly as possible. Every antiseptic precaution must be taken, and the operator ought to wear rubber gloves. As regards the child, it can hardly be said that there is any special danger, save from delay in labour. Of course, if the maternal parts are infected, the child is likely to be also infected during birth, but this is a remote contingency. The child should be at once taken from the mother's room and not again brought into it, until it and the mother are free from infection. The period of duration of infection is probably six weeks, but it is variable, and can only be ascertained by examining cultures taken from the mother's throat. When these are found to be free from the diphtheria bacillus, a thorough disinfection of the room and everything in it must be carried out.

ENTERIC FEVER

The opinion of Rokitansky and Niemeyer that pregnancy confers almost complete immunity from enteric fever, is not by any means borne out by our own experience, which on this point coincides with that of Murchison. Curschmann* does not consider that immunity is at all considerable. 'In Hamburg, among 1,117 women, 38 were pregnant—3·4 per cent. . . . Even at those periods of life in which the predisposition to the disease and the chances of pregnancy are diminished, the figures are relatively high.' It has also been asserted that lactation confers immunity. This opinion cannot be upheld either. Numerous cases of a mother in the early stage of enteric, suckling her infant, have come under our care in hospital, and Moore† also has cited several cases.

Effects on Pregnancy.—In our experience, the association of pregnancy and enteric fever is much less serious than it was formerly considered to be. In an ordinary and otherwise uncomplicated case, the course of the fever does not appear to be in any way influenced, and as a rule a living child is born at full term. If the fever occurs during the earlier months, the child at full-term birth appears well-nourished and strong; if during the later months, the child is smaller than usual, but otherwise healthy. The premature expulsion of the ovum appears to occur with much greater frequency in cases in which the fever occurs either during the first four months or during the last two months of pregnancy.

Curschmann's experience agrees with the foregoing. Of the thirty-eight women mentioned above, three went to term, and were delivered during convalescence of living children, while fourteen, 42·1 per cent., were discharged after recovery from the attack of typhoid fever without interruption of the pregnancy. Of the other patients, in whom abortion or premature labour took place, three died. The mortality during pregnancy was therefore 7·8 per cent.

Dreschfeld,‡ quoting Veniat, states that in pregnant women the mortality was 17 per cent., abortion occurring in 66 per cent.; that on the introduction of the cold-bath treatment, it fell to 6 per cent., with 55 per cent. abortions; and that in puerperal women, the mortality is nearly 50 per cent.

The above mentioned mortality of 17 per cent. in pregnant women is slightly less than the general percentage mortality for enteric fever in the Glasgow Fever Hospital§—viz., 17·29 per cent., whereas the general mortality for enteric in Cork Street Fever Hospital, Dublin (1871-1890), was only 8·6 per cent. It is to be regretted that no statistics of pregnancy cases are available in the latter hospital, as we believe they would give a much lower percentage both with regard to mortality and to premature delivery than that given by Veniat.

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* 'Nothnagel's Encycl.,' English ed., article 'Typhoid Fever.'

† 'Eruptive and Continued Fevers,' p. 402.

‡ 'Allbutt's System of Medicine,' vol. i., p. 845

§ *Ibid.*

The occurrence of bronchitis, so usual in enteric fever, should be looked on as a serious menace to the course of pregnancy, and every available measure should be employed in its early stages to combat its advance. As respiration is accelerated by the fever, and is at the same time impeded by increased abdominal pressure on the diaphragm from the distended bowels and the pregnant uterus, bronchitis is very liable to extend, and if it does so sufficiently to cause cyanosis, or if pneumonia supervenes with the same result, labour will almost certainly ensue.

When abortion occurs early in the disease, a high range of temperature will generally be found to be the determining cause, consequently, efforts should be made to bring the temperature, even temporarily, down to a lower level. This is perhaps best attained by watching the evening rise, and as soon as it reaches 103° F. applying iced cloths for twenty minutes. Such a method appears to be better than that of placing reliance on any form of drug, as, even if this attains the object sought for, it also depresses the patient.

It appears certain that the fœtus is also infected by the fever-poison, but, as a rule, it passes through the ordeal successfully, unless prematurely separated from the mother. The fœtal blood gives Widal's reaction well. In a recent case in Sir Patrick Dun's Hospital, Dublin, in which premature delivery occurred, the mother's blood, diluted $\frac{1}{40}$ with eight hours' culture of *B. typhosus*, gave a strong reaction. The fœtal blood taken twenty-four hours after death from the right auricle, diluted $\frac{1}{30}$ with eight hours' culture, caused clumping in five minutes (Joynt).

Such undoubted authorities as Eberth, Widal,* and Giglio,† have found the *B. typhosus* (Eberth's) present in the blood of a fœtus suffering from enteric, and Lynch‡ has collected sixteen cases in which typhoid bacilli have been isolated from the organs of the fœtus.

The very young infant generally escapes infection, even when it has been suckled by the mother during the early days of her attack. The disease is, however, less rare in young children than was formerly supposed, and without doubt many cases of infantile remittent fever are really enteric, which in these young subjects usually runs a mild course and is difficult to diagnose.

Treatment.—Enteric fever always causes anxiety, and the addition of pregnancy as a complication must, in spite of what has been said of a reassuring nature, greatly increase this. Remembering the ill effects which anxiety, trouble, and worry, have on any patient, especially on those who have to go through a long and trying illness such as enteric, we must be doubly on our guard against imparting any of our fears to the patient. We are, we think, even justified in making light of the fact of pregnancy being present, and should certainly *appear* to ignore it in our daily examination of the patient. In treating the enteric fever, we follow the same lines as in the case of a non-pregnant patient. We must recognise, however, the pressing danger of bronchitis and high temperature, and deal with them as above indicated. The friends ought to be warned that premature delivery may occur, in order that the necessary preparations may be made. By far the most important precautionary measure is scrupulous cleanliness. With a more or less helpless patient, who passes frequent and liquid evacuations into a bed-pan, soiling of the person and clothing is prone to occur, and the regular sponging of the one with antiseptic solutions, and the frequent changing of the other, are essential to minimise the risk of sepsis after delivery.

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* *Centralbl. für die Med. Wochensch.*, June 1, 1889.

† *Centralbl. für Gynäkol.*, No. 46, p. 819, 1890.

‡ *Johns Hopkins Hospital Bull.*, vol. xii.

When labour does come on, vaginal examinations must be avoided and the expulsion of the fœtus be left, as far as possible, to the natural efforts, which are, as a rule, sufficient. If, however, the patient is very weak from protracted or severe fever, or if labour is not completed within a few hours, delivery must be expedited by the application of the forceps. Owing perhaps to the softening and relaxation of the maternal passages due to the fever, labour is usually accomplished with comparative ease and with little delay. Too much care cannot be devoted to every detail in obtaining the most perfect asepsis possible. Accidents such as intestinal hæmorrhage or perforation do not appear to occur as the direct outcome of labour. These accidents may occasionally occur, but we have not known of such, and they have not been noted in the experience of other writers.

If possible, a special nurse should be engaged for the obstetrical nursing, while another nurse carries out the general nursing. This, however, though very advisable, is not so necessary as in other infective diseases.

ERYSIPELAS

Erysipelas may occur in the pregnant or parturient woman as a primary local infection, or secondary to a general septic infection. There is no reason for supposing that its primary occurrence is more common in such women than in any others, but, inasmuch as the parturient woman is especially exposed to the risk of septic infection, the occurrence of secondary erysipelas may be relatively more common during the puerperium than at other times.

Effect on Pregnancy.—Since the temperature in erysipelas, as a rule, rises suddenly, and is frequently associated with acute 'sthenic delirium,' erysipelas is very prone to bring about the premature expulsion of the ovum. If this occurs, or if erysipelas starts primarily during the puerperium, the danger of the extension of the invading bacteria to the genital organs, and the consequent occurrence of a local, or of a general, septic infection is very great. Infection of the newly-born infant, usually through the umbilicus, is also prone to occur, and will probably prove fatal.

Treatment.—Precautionary measures are of the first importance. As Felheisen has shown that the cause of erysipelas is a streptococcus very closely allied to, if not identical with, *Streptococcus pyogenes*, it is reasonable to administer at once hypodermically 10 c.cs. of antistreptococcic serum, not only with a view of curing the disease, but as a prophylactic measure in the event of delivery taking place, and this dose should be repeated daily until the symptoms disappear. Should labour come on during the disease, the most elaborate precautions must be taken to prevent infection. At the same time, it may be assumed that infection will take place, and prophylactic doses of antistreptococcic serum should be continued. The prospects, however, are grave from the first, and erysipelas in the puerperal state is acknowledged by all writers as almost certainly fatal. Its curative treatment is identical with that of septic infection, and will be discussed subsequently.

INFLUENZA

The symptoms and consequences of influenza have been so variable in different epidemics, that it is difficult to make any general statements regarding its effects on pregnancy. There are, however, certain consequences definitely associated with influenza, that must be regarded as of extreme gravity when they occur during the pregnant state. These are, profound mental depression with physical weakness, a peculiarly malignant form of pneumonia, peripheral neuritis of random distribution and which sometimes affects vital nerves, and mental derangement. The cause of the last-named is not difficult to find. Marked mental depression is a frequent occurrence in influenza even in the non-pregnant, and serious mental disturbances occasionally occur during an apparently normal pregnancy. It is therefore but natural to expect that when influenza and pregnancy are associated, the probability of the occurrence of insanity is greatly increased.

Pneumonia in influenza, even in the non-pregnant woman, has deservedly earned a bad reputation, and when it occurs during pregnancy it is a far more serious condition. In consequence of the high temperature and the cyanosis, it is most probable that premature labour will result, and the effect of this, added to that of the disease, is highly dangerous to the life of the woman.

If there is any extensive manifestation of peripheral neuritis, the resultant loss of muscular power further complicates matters. If the nerves to the voluntary muscles alone are involved, the prolongation of labour may be the only consequence, but, if the visceral nerves, and particularly the cardiac nerves, are also affected, the result of the additional strain of labour is very likely to cause fatal syncope.

Treatment.—This consists in keeping up the patient's strength and spirits from the first. The terrible depression which accompanies influenza is, we believe, often increased by the mere knowledge of the fact that it is influenza. So many patients have had experience of its ill effects, either on themselves or on their relations or friends, that in some households its appearance causes more alarm than does any of the ordinary infectious fevers. It may therefore be justifiable to conceal, if possible, the real nature of the disease, and to label it with any other term or terms which would suit the symptoms. If labour occurs, it should be hastened as much as possible, and delivery effected by the forceps at the earliest possible moment. The use of an anæsthetic is usually contra-indicated—ether because of the great liability to lung complication, chloroform because of the cardiac weakness. If, however, the heart is regular and beating with fair force, and there is a good first sound, the obstetrical degree of chloroform anæsthesia may be induced.

MEASLES

Measles is a disease of childhood. Between the first and fifth years of life the percentage of cases in which it occurs is very high, and has been estimated at 47·8 per cent., whereas for the whole period of life after twenty years of age the percentage of cases is only 0·7.* It is for this reason alone that pregnant women are very rarely attacked by measles, and not, as has been suggested, because pregnancy confers any immunity. We thoroughly agree with Dawson Williams† that 'No age, however advanced, affords protection, and infants have been born with the rash.' This, however, is not the usual teaching, which is that there is a certain amount of immunity during the first five months of life. Von Jürgensen‡ says that 'A pregnant woman who contracts measles may communicate the disease to her unborn child. The poison must be able, therefore, to pass through the placenta. About twenty cases have been reported in all.' After this statement, one is surprised to find the same writer§ also stating that 'A partial, temporary immunity is universally conceded. This covers the first five months of infancy.' It is difficult to imagine a change which could come over a child at the moment of birth, and which could render it immune to a disease to which it was previously and subsequently liable.

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* 'Nothnagel's Encycl.,' English ed., article 'Measles,' p. 237.

† 'Allbutt's System,' vol. ii., p. 111.

‡ 'Nothnagel's Encycl.,' English ed., article 'Measles,' p. 237. § *Loc. cit.*

In adults suffering from measles, the temperature generally runs up rapidly to a high point, 104° or 105° F. not being uncommon at the commencement of the eruptive stage. This high and rapidly attained range is very prone to bring on abortion or premature labour. Later in the disease, in addition to high fever, bronchitis may supervene, and, if it is severe enough to produce cyanosis, there is almost a certainty of the pregnancy being abruptly terminated. As measles is often associated with septic processes, such as purulent or ulcerative conjunctivitis, septic sores about the nares and mouth, cancrum oris, and noma pudendi, the risk of secondary uterine infection occurring in such cases, is considerable.

Treatment.—The treatment chiefly resolves itself into an attempt to reduce a high temperature and to combat an attack of bronchitis. The former attempt will be of little avail, and even that little is but transitory. The best means of guarding against bronchitis is to keep the patient's room at an equable temperature, taking care that it does not fall during the night and early morning hours. It is the variations of temperature, rather than the actual height, that are dangerous to the life of the ovum. If labour comes on, the risk of septic infection must be remembered, and every effort made to guard against it.

PHTHISIS

Playfair stated very definitely that 'phthisical women are not apt to conceive.' This may be true in advanced or long-standing cases, but it is well recognised that women with the so-called tubercular diathesis—*i.e.*, of tubercular stock or with the constitution which is very prone or non-resistant to the invasion of tubercle bacilli—appear to be very prolific. Rapid childbearing runs down their strength so much that, if they have so far escaped phthisis, they become extremely prone to contract it. This is borne out by the statistics and investigations of both Flint and Gaulard, which show that a large percentage of women become phthisical during pregnancy. It is further borne out by the fact that phthisis is more prevalent among married than among unmarried women in the proportion of nearly three to two.* It is probable, too, that the influence of childbearing on phthisis accounts largely for the sudden increase in female, as compared with male, mortality between the ages of twenty and thirty-five.

From a considerable experience obtained in the out-patient department of Sir Patrick Dun's Hospital, Dublin, in a district where there is a prolific population, it was impressed upon us with increasing force that in Ireland at any rate Playfair's dictum does not hold good. The number of pregnant women who suffered from phthisis was considerable, and in many cases subsequent pregnancies followed one another rapidly.

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* *Cf.* First Brompton Report—Thompson, 'Family Phthisis.'

Effects on Pregnancy.—If a woman already phthisical becomes pregnant, the course of the disease is as a rule little affected during the period of gestation, and if prior to conception she had few symptoms, the latter are not markedly increased. If, on the other hand, she had grave and well-marked symptoms, they may undergo a temporary improvement, there may be less sweating and cough, a better appetite, and a more normal range of temperature. The child may be carried to full term, and, unless the disease was very advanced, may appear well-nourished and healthy. If the mother survives the puerperium, and does not nurse the child, she may on the earliest opportunity again become pregnant, but, even in the short interval, the phthisical symptoms become much worse. If the mother nurses the child, these phthisical symptoms usually manifest themselves in a still more aggravated manner, as the loss of strength is more rapid on account of the drain of lactation. When pregnancy occurs, the constitutional symptoms then abate somewhat, the lung condition, as it were, stands still for a time, or at least does not make such rapid advance as it had previously made. There is not, however, any real improvement, as has often been erroneously supposed to occur—an ignorant fallacy owing to which women have sometimes been urged to marriage and pregnancy, as a supposed benefit, if not a cure, of phthisis. In twenty-seven cases collected by Grisolle,* the average duration of the disease was only nine and a half months.

As a rule, the child is carried to full term and parturition is normal. If the phthisis has reached its final stage, the patient will probably live just long enough to bring the child to full term and give it birth. Labour is apparently the last effort of Nature, and when it is accomplished the mother dies.

It should be remembered that, even in healthy women, over-lactation may cause symptoms which may be mistaken for phthisis. The patients become weak and pale, lose flesh, and develop night-sweats, and if, in addition, they catch an ordinary cold, and are unable to shake off a cough, the diagnosis is difficult in the extreme. The proper treatment in such cases is to stop lactation. The diagnosis will then soon be cleared up by the rapid improvement and restoration of health. The effect of maternal phthisis on the fœtus is eminently deleterious. It has been said above, that the child often appears well nourished and healthy, but this remark only refers to the first child after phthisis has manifested itself, and to cases in which the advance of the disease is not very rapid. If the infant is nursed, it runs the very serious risk of maternal infection either through the milk, or, more probably, from material expelled from the lungs. It is therefore obvious that both for her own sake and that of the child, the mother should not breast-feed it. The result of a second or subsequent pregnancy is almost certainly a weakling. As Gaulard says:—'The children born of phthisical mothers are usually feeble, often at first become scrofulous, and subsequently tuberculous.' Besides this, premature delivery is not uncommon when the disease is very acute and accompanied by great and rapid alternations of fever, and here, again, the child is either born dead or soon succumbs.

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* *Arch Gén. de Méd.*, vol. xxii.

The subject of transmission of tuberculosis to the ovum has been dealt with in a previous chapter (Part VI., Chap., ii.).

Treatment.—If, from the family history or the examination of the patient, there is reason to suspect that she lacks the normal power of resistance to tubercle invasion, she should be warned to avoid repeated pregnancies and prolonged lactation. Pincus* has gone so far as to recommend and to practise the use of atmocausis in cases of phthisis, with the object of completely destroying the endometrium, and so rendering pregnancy impossible.

There are differences of opinion as to whether pregnancy in phthisis should be artificially terminated or not. The weight of opinion seems to be against this, in that it does no permanent good. It may, however, be indicated as the only means by which the life of the fœtus can be saved.

The treatment of labour in phthisis does not call for much discussion. As a rule, the mother expels the fœtus by the natural efforts, but, if there is any delay or if her strength fails, the forceps should be applied as soon as possible, and delivery thus effected.

PNEUMONIA

In a disease such as pneumonia, where the temperature rises suddenly to a high level, often with severe rigors, and is maintained there, the liability to, indeed the probability of, premature delivery is very great, even in the early days of the disease. Again, later in the course of the disease there is a tendency to cyanosis, and an increased probability of premature delivery if that event has not already occurred.

Pneumonia being a serious disease with a high mortality, it is natural that the latter should be raised by the complication of pregnancy. As it is an acute and 'sthenic' disease, one would expect the labour to be accomplished without artificial aid, and if delivery took place at an early stage in the pneumonia, the child to be born alive, and, if viable, to survive; while, if labour had been brought on by cyanosis, one would expect the cyanosis to have probably first caused the death of the child.

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* *Centralb. für Gynak.*, No. 8, 1902.

These *a priori* deductions are borne out by the very few and extremely scattered references, that are to be found in contemporary writings, to the effect of pneumonia on pregnancy, and also by such cases as have been under our own care. Moore* considers that one reason for the higher mortality in pneumonia in women than in men is that the complication of pregnancy adds immensely to the danger, while Playfair† recorded fifteen cases collected by Grisolle, of whom eleven died,—a very high mortality. The larger proportion also aborted, the children being generally dead.

Treatment.—We do not know of any treatment that will lessen the risk of premature delivery in pneumonia. Should labour come on, it must be terminated as soon as possible, especially in the presence of marked dyspnœa, cyanosis, or symptoms of failing heart, else both lives will probably be lost. The relief of abdominal pressure, and the hæmorrhage consequent on labour, appear to be beneficial in easing the respiration and relieving the engorgement of the right side of the heart, so that when labour has been safely accomplished the patient is usually considerably relieved, and sleep—the thing most frequently wanting, the most difficult to obtain, and the most beneficial when it occurs—is obtained. The puerperal state must be managed precisely as in any normal case, and there is no increased risk of sepsis. The pneumonic condition must be treated throughout as though pregnancy was not present. Stimulants will probably be required, but should be withheld if possible till the time of labour. At this time, hypodermic injections of strychnine and the administration of digitalis may also be required if there are any signs of heart failure, and oxygen inhalations may be of some slight value in cases in which cyanosis is marked. If the right side of the heart is engorged, venesection to the extent of twenty to thirty ounces gives some relief.

RELAPSING FEVER

Relapsing fever is now such a rare disease in these countries that its consideration might here be dispensed with. It is, however, interesting to briefly record its influence on pregnancy, as affording strong support to the second general conclusion we have already stated, namely, that fevers in which the temperature goes through sudden and great variations are more liable to bring about premature delivery than are those in which the temperature, though high, reaches its maximum gradually. In the absence of any personal experience of the disease, we must rely altogether on the experience of Murchison, and on cases collected by him. He considers that relapsing fever is far from being a fatal disease, and that as compared with typhus or enteric fever, its rate of mortality is extremely small, about 1·84 per cent. Miscarriage almost invariably occurs, according to Cormack, most frequently during the period of the relapse. Of nineteen cases under Jackson of Leith, twelve aborted during the first paroxysm; six during the second; and one during the third. Premature delivery is the rule with exceedingly few exceptions. It is probably due to the very rapid rise in the temperature, which within twelve hours often runs up to 104° or 106° F. Delivery is sometimes followed by copious hæmorrhage, or by rapid sinking and death; but, as a rule, the mother recovers, although, even when pregnancy is advanced, the child is still-born, or only survives a few hours.

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* 'Encyclopædia Medica,' article 'Pneumonia,' p. 446

† 'Science and Practice of Midwifery,' vol. i., p. 247.

Treatment.—There does not appear to be any special treatment of value, as nothing that we know of will cut short the disease or lessen the risk of abortion. There is no special danger of septic infection.

SCARLATINA

The occurrence of scarlatina during pregnancy is extremely rare. Amongst the 228 cases of scarlatina in females between the ages of fifteen and forty which have been treated in Cork Street Hospital, Dublin, during the past four years, we have not seen a single case of pregnancy, though cases have been admitted in the puerperal state. Von Jürgensen* states that the extreme rarity of scarlatina during pregnancy is generally accepted as a fact, while Olshausen† was only able to discover seven cases.

A partial explanation of this rarity may be the fact—which obtains in this country at all events—that there is probably no form of sickness which the public hold in such dread as scarlatina in association with pregnancy, and that consequently greater precautions are taken to avoid infection than in the case of any other disease. It is probable that this wholesome fear originated from the teaching of the older midwives, who, confusing septicæmic rashes with scarlatina, held that puerperal women were extremely prone to take infection and were almost certain to die.

For years, a controversy has raged around the subject of so-called 'puerperal scarlatina,' which was supposed to be prone to break out as an epidemic amongst puerperal women, to assume a grave and toxic form, and almost invariably to result in a fatal termination. The British school is largely responsible for maintaining the existence of this special form of scarlatina, but it secured some ardent supporters on the Continent. Olshausen is one of these, and his advocacy led him to take up the following curious position:—'We are impelled,' he says, 'to the belief that the incubation period (of scarlatina) tends to lengthen itself out during the time of pregnancy, and last months even, under certain circumstances, until with delivery the contagion springs forth into active eruption'![*] Such an assertion shows the straits to which the supporters of the existence of 'puerperal scarlatina' are driven, and the length they will go in the endeavour to support their case. It cannot be maintained, however, that the tendency to scarlatina is in any way increased by the trauma of delivery. Several typical cases have come under our observation, in which scarlatina attacked women in the puerperal state. The disease ran a rather more severe course than the average of the cases of scarlatina under observation at the same time, and the milk was suppressed. There was no change in the lochial discharge other than a slight increase in its amount. In each case the patient recovered, and the infant having been removed from the mother when she became ill, did not develop the disease. On the other hand, we have seen a considerable number of cases of puerperal septicæmia in which there appeared a widespread or universal scarlatiniform rash, and in no way did they differ from non-puerperal septicæmia in which a similar form of rash appeared. They were, in fact, cases of general septicæmia occurring in the puerperal state, and ran such a course as would be expected in such cases, and not the course of scarlatina.

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* 'Nothnagel's Encyclopædia,' English ed., article 'Scarlatina,' p. 398.

† *Archiv für Gynäkologie*, 1876, vol. ix., p. 188

We thoroughly agree therefore with the position taken up by Dakin,[†] when he says that scarlatinal infection results in scarlatina, and nothing else, in a puerperal woman. She may have septicæmia as well, but this must be from an independent source.

We do not propose to enter into the arguments for and against this question, but, if further information on the subject is required, it will be found very fully and fairly discussed by von Jurgensen.[‡]

Effects on Pregnancy.—It is to be expected that, with the sudden and severe symptoms which usher in a well marked case of scarlatina, the course of pregnancy will be seriously endangered; and so it appears to be. Litten[§] says that abortion usually follows, and the more surely so, the younger the state of pregnancy. Playfair[‖] stated that if scarlet fever of an intense character attacked a pregnant woman, abortion was likely to occur, and that the risks to the mother were very great, while the milder cases ran their course without the production of any untoward symptoms. Dakin says that albuminuria is probably more constant than in scarlatina occurring in the non-pregnant. He also considers that the onset of scarlatina in the later weeks of gestation may precipitate labour a week or so, and that labour is apt to be delayed by uterine inertia. The lochia are normal, or a little increased, and the milk is diminished or arrested. He adds that, in the new-born child, the disease appears soon after birth, but with this, however, we do not agree. Craiger* believes that the danger to life enormously increases with the proximity to the time of delivery at which the symptoms of the disease appear, and says that it should be remembered that the onset of labour may be one of the invasion symptoms of the disease itself, but that this, however, rarely occurs unless the woman has almost completed her full term.

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[*] Olshausen, quoted by von Jürgensen in 'Nothnagel's Encyclopædia,' English ed., article 'Scarlatina,' p. 402 *et seq.*

[†] 'Handbook of Midwifery,' London, 1897, p. 545.

[‡] 'Nothnagel's Encylopædia,' *loc. cit.*

[§] *Charité Annalen*, vol. vii., § 173.

[‖] *Loc. cit.*, i. 246.

The consensus of opinion may thus be said to show that in severe cases there is great liability to premature delivery, and a serious danger to the life of the mother. The real danger, in our opinion, occurs during the puerperium, and is the result, not of the scarlatinal infection itself, but of the putrid septic discharges with which scarlatina is very frequently associated. Aural, nasal, faucial, and cervical glandular discharges—one or all—may be present; they are virulently septic, and it must never be forgotten that from these the patient may—indeed, is likely to—infect herself. Hence it is, that scarlatina has such a bad name in pregnant or puerperal cases; but it is sepsis, not scarlatina, that is responsible, and it lies within the power of the medical attendant to rob these cases of their danger, by taking the necessary precautions against septic infection.

Treatment.—In a mild case of scarlatina, it is probable that the pregnancy will run on without interruption. If the case is a severe one, labour should be expected and preparations made accordingly. If possible, the family physician should insist that a separate nurse and doctor are obtained for attendance in such an event. The obstetrician should not attend another labour until he has undergone thorough disinfection, and has allowed at least seven days to elapse. Any discharge from the nose or throat should be constantly removed with pieces of wool or rag and immediately burned, the patient being warned against fouling her hands with these discharges. Any discharge from the ear or from a cervical gland should be collected on an antiseptic dressing, which is kept firmly in place by a bandage. After delivery, especially if the patient is delirious, the hands must be tied up in clean cloths, to prevent them from touching the vulva, and the latter should also be protected by carefully applied dressings. The urine ought to be examined daily for albumen. If it is present, whether late or early in the case, saline purgation should be at once commenced. The quantity of urine passed daily must also be noted, and any decided diminution met by diaphoresis. The best method of effecting this is probably the hot pack, as it is sure in its action, does not weaken the patient, reduces the temperature, and usually induces sleep.

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* 'Allbutt's System of Medicine,' ii. 147.

Labour, if it comes on, will probably be accomplished easily and without undue delay. It is well to avoid vaginal examination or interference of any kind as much as possible. If it becomes necessary to aid Nature, this should be done with the most elaborate antiseptic and aseptic precautions, and rubber gloves must be worn throughout by both the medical man and the nurse. As scarlatina patients are liable to excited delirium, and as they bear sedatives well, a good sedative draught should be given when the third stage of labour is completed, and the patient then left to as perfect rest as possible. The breasts do not give trouble during the fever period, even if the pregnancy is advanced, as the milk is usually suppressed.

SMALL-POX

Whether in its modified or unmodified form, small-pox has hitherto been looked upon as one of the most deadly complications of pregnancy. Up to the present, most, if not all, writers are agreed in considering it a source of the very greatest danger to the life of the pregnant or puerperal woman, and to the life of the fœtus of either early or late term. Playfair was of opinion that, of the eruptive fevers, variola has the most disastrous results in pregnancy, that the severe and confluent forms of the disease are almost certainly fatal to both the mother and the child, but that while in the discrete and modified form, abortion frequently results, it does not necessarily do so. In the Dublin epidemics of 1871 and 1878, it was noted that pregnant and recently-delivered women were particularly liable to fatal hæmorrhagic small-pox, but there are no statistics available. During the Dublin epidemic of 1894-1895, a large number of cases of small-pox were treated in Cork Street Fever Hospital, and our recollection tends to support the above views. It is, however, unfortunate that no special statistics were made concerning pregnant cases.

Dr. Ricketts, of Long Reach Hospital, has kindly enabled us to give some observations made by him during the recent epidemic of small-pox in London of 1901-1902. His conclusions and figures are surprising in view of all we have just said, and are so interesting that it is to be hoped he will make them more complete by a full investigation and publication, as the cases he deals with here 'are only a fraction of the total number treated.' For our benefit, he had special attention paid to the relation of small-pox to pregnancy, in 1,500 consecutive cases, and, from the statistics, considers that the danger both to mother and child of an attack of small-pox complicating pregnancy has been very generally exaggerated.

His figures are as follows:—Of 1,500 consecutive cases, 419 were adult females, and of these 30 were pregnant. Four women aborted, the latest being at the seventh month, in which case the child died immediately; four women were delivered of living children at full term, two of which lived and two died. Three women died undelivered, one woman died after abortion, and one woman died after delivery at term. From this it appears that, of thirty pregnant women, only five died and only four aborted. These are certainly remarkable results, and give cause for a more hopeful view in such cases than we have hitherto been led to take.

During 1903, a small outbreak of small-pox occurred in Dublin. The cases were all treated at the isolation hospital which was placed in connection with Cork Street Fever Hospital. There were 123 female patients, of whom fifteen died, seventy were between the ages of fifteen and fifty, and of these six were pregnant. Of the six pregnant cases, three died—two in the puerperal state with bad confluent small-pox on about the sixteenth day, and the third when convalescent from the disease. They were in the third, sixth and seventh month of pregnancy respectively, one child was born dead and the other survived for two hours. The remaining three pregnant cases recovered without any interruption to pregnancy—of these, one was in the eighth month, and two were in the fourth month of pregnancy. One, at least, was subsequently delivered of a healthy child.

The fœtus *in utero* can be infected by small-pox, and in some cases is born with cicatrices of the rash, or with the actual rash itself. This, however, is rare. According to Ballantyne, infants whose mothers suffered from small-pox during pregnancy are also immune to subsequent infection, even though they may have apparently completely escaped intra-uterine infection. Such infants are also usually insusceptible to vaccination.

During the end of 1902, a large number of letters appeared in the *British Medical Journal* on the effect of revaccination, during pregnancy, on the child; and, though the experience of the writers varied, the correspondence on the whole tended distinctly to bear out the opinion that the successful vaccination of a woman during pregnancy had a distinct effect upon the child. This effect, however, is not very powerful, and frequently a good or modified result is obtained from subsequent vaccination, though, perhaps, not until after several trials. Even if earlier attempts fail, a good result can generally be obtained after about one year. We hope that the statistics from the recent London epidemic will be fully made up on all these points, and so give us some actual data on which to found a judgment, instead of the indefinite statements with which we have hitherto had to be content.

Treatment.—The management of labour during small-pox chiefly resolves itself into precautions against septic infection. As a rule, labour comes on quickly, and is accomplished with comparative ease and without undue delay. There is a decided risk of dangerous hæmorrhage, but this is usually foreshadowed by the hæmorrhagic character of the case, and such cases are usually fatal, in spite of anything that can be done. In non-hæmorrhagic small-pox, there does not appear to be any undue tendency to post-partum hæmorrhage. If such occurs, it must be dealt with promptly by the usual recognised methods. Intra-vaginal manipulations must be avoided on account of the great danger of sepsis. This precaution is especially necessary in the late stages of the disease, as at this time boils, or septic abscesses, all over the body are not uncommon, and the risk of genital infection from their discharge is very great. If, however, the natural efforts are insufficient to effect a quick delivery, they must be assisted promptly and rapidly, as in many cases the patient's strength cannot withstand the over-exhaustion of protracted labour, which in such cases may be a greater risk to life than is septic infection.

SYPHILIS

The effects of syphilis in pregnancy are important and far-reaching so far as the ovum is concerned, though, as regards the mother, they differ but little from those met with at other times. The effect of syphilis on the ovum differs considerably according to the period at which the infection is contracted, and in general it may be said that the nearer the date of inoculation to the date of conception, the greater the danger to the life of the ovum. It is well known that, in the pregnant woman, syphilis often runs what might be termed a benign course. In 1837, Colles* of Dublin drew attention to the numerous instances in which a married woman had no suspicion herself, nor gave any cause for suspicion to her physician, that she was syphilitic, till the birth of an infected child gave indisputable evidence of the fact.

The effect of the disease, though it may not be manifest in the mother, has an unfailing and profound effect upon the ovum. In general, this is to cause the death of the embryo or fœtus, and premature expulsion of the ovum, time after time, in successive pregnancies. The typical sequence of events is somewhat as follows:—In her first pregnancy, the woman aborts about the 3rd or 4th month; in her second pregnancy, she again aborts about the 4th month; in her third pregnancy, about the 5th or 6th month; in her fourth pregnancy, about the 7th month; in her fifth pregnancy, she may go to full term, but give birth to a dead and macerated fœtus; in her sixth pregnancy, she may give birth to a living child, which exhibits signs of syphilis, and which survives its birth but a short time—hours, days, or weeks; in her seventh pregnancy, a living, healthy-looking, and well-nourished child is born, and continues apparently in good health for a short period, it may be eight days or as many weeks, when unequivocal signs of the disease appear, which, if not properly treated, may soon prove fatal. It is also quite possible that between these infected children, a child may be born in a healthy condition and may remain so. Such a sequence of events as the above is now but seldom met with, as the meaning of repeated abortion and of the characteristic appearance of the fœtus, are so well understood that the course of the disease is immediately modified by appropriate treatment.

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* Abraham Colles, 'Practical Observations on Venereal Diseases,' London and Dublin, 1837

The effects of syphilis may, and most commonly do, differ in several particulars from those just described. In the first place, the woman frequently manifests the ordinary signs of syphilis, in the primary sore and the constitutional symptoms with secondary manifestations. Further, the effects on the fœtus also show wide variations. Thus, in some cases, syphilis may not cause abortion, and the mother may be delivered at term either of a dead child bearing evident traces of the disease, of a living child similarly affected, or of an apparently healthy child in whom the disease only manifests itself after some weeks or months, or even not at all. These varying effects probably depend on the date of infection relative to conception and on the intensity of the poison. If the mother contracts the disease at the time of conception, the infection of the fœtus would seem to be certain; the longer the period that has elapsed since the disease was contracted by the mother before conception takes place, the better is the prognosis for the child; and, if the mother contracts the disease at a late period of pregnancy, the child may entirely escape. If the mother develops secondary symptoms, they will be evident in such constitutional disturbance as loss of flesh, restlessness, fever, anorexia, and pains in the bones and joints; these, however, vary greatly in degree in different subjects, sometimes hardly attracting attention, in other cases being of a grave and serious nature. Eruptions and ulcerations of mucous membranes may also be seen. Hydramnios is a very frequent result of fœtal syphilis, so frequent, indeed, that some writers have considered it to be pathognomonic, a proposition that cannot be maintained, but which serves to show how constant is the association of the two conditions. The premature interruption of pregnancy has been already referred to as a frequent effect of syphilis; labour coming on, either as a result of pathological changes in the ovum, or of the hydramnios.

During labour, the complications which may arise as an indirect result of syphilis are those associated with the presence of hydramnios, and also retained placenta and post-partum hæmorrhage.

During the puerperium, there is danger of septic infection if there are chancres or other form of local syphilitic eruption about the vulva, if the fœtus has died *in utero* and putrefied, and if fragments of placenta and membranes are retained.

The changes in the ovum that result from syphilis have been already referred to (Part VI., Chap. ii.).

Treatment.—As soon as the symptoms of syphilis are recognised, both parents should be put under treatment. In the early stages, mercury alone is indicated. The most convenient form in which to administer it is perhaps as a pill, such as—

℞	Hydrarg. c. Cretæ - - - - -	gr. i.
	Pulv Ipecac. Co. - - - - -	gr i.
	Ext. Gentiani - - - - - -	q s.
	M.	

To make one pill. One to be taken three times a day.

This treatment should be continued for six, nine, or twelve months, unless salivation is threatened, when the drug is stopped for a time, and a smart saline purge is given. In the later secondary stage, iodide of potassium should also be given. It is better to combine the two drugs, as mercury is always indicated for the benefit of the fœtus, and they may be given in mixture, *e.g.* :—

℞	Liq. Hydrarg Perchlor. - - - -	ʒxii.
	Potass. Iodidi - - - - - -	ʒi.
	Ext Sarsi Liq. - - - - -	℥iii.
	Aquam ad - - - - - -	℥vi.
	M ʒss. *ter in die*	

This mixture, though chemically incompatible, is a recognised method of prescribing, the mercuric iodide formed being kept in solution by the excess of potassium iodide. Some writers consider that in the case of a pregnant syphilitic woman it is safer to treat by inunction rather than by mercury administered by the mouth, but our experience does not show that this is so. By adopting anti-syphilitic treatment in the case of both parents, not only miscarriage, but also the occurrence of syphilis in the infant may be prevented.

The child should be nursed by the mother, if the latter is able to nurse, and on no account be given to a wet-nurse. If it has any evidences of active syphilis, especially of sores of any sort about the genitals, increased precautions must be taken that it does not infect any other person. The mother herself is immune, and comes under the second well-known law of Colles* of Dublin, 'That a child born of a mother who is without any obvious venereal symptoms, and which, without being exposed to any infection subsequent to its birth, shows this disease when a few weeks old, this child will infect the most healthy nurse, whether she suckle it or merely handle and dress it; and yet this child is never known to infect its own mother, even though she suckle it while it has venereal ulcers of its lips and tongue.'

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* *Loc. cit.*

Prognosis.—In parental syphilitic infection, the prognosis as regards the ovum is very bad, if special treatment has not been adopted. Repeated death of the fœtus in successive pregnancies is, as has been pointed out, the rule. If a living child is born, it shows, or will almost certainly show, symptoms of the disease, which if they do not end fatally, bring about such conditions as result in permanent impairment of the health. The result of treatment systematically and perseveringly carried out is satisfactory. Abortion is prevented, the disease is arrested, and the fœtus, carried to full term, is born in a healthy well-nourished condition. Where treatment is incompletely carried out, an apparently healthy child may be born, which, in later months or years, shows evidences of the taint in snuffles, fissures, badly-developed teeth, interstitial keratitis, and such conditions.

XIII TYPHUS FEVER

Typhus fever is now a comparatively rare disease in these countries, and consequently its connection with pregnancy is not so important as is that of most of the other specific fevers with which we have dealt. For this reason, too, it is difficult to speak from our own experience, or from the experience of others whose treatment has been modified by modern antiseptic practice.

It appears, however, that, contrary to expectation, the complication of pregnancy in typhus fever is not particularly unfavourable. With such a grave disease, marked, as a rule, by a high and rapidly attained range of temperature and by severe constitutional symptoms, one would expect almost certain abortion, and probably maternal death. Such consequences, however, do not appear to be the case. Murchison* says that pregnancy adds little to the danger of typhus fever, but that suckling induces anæmia and increases the chance of death by asthenia. He considers that pregnant women are not exempt from typhus fever; that women, even in an advanced stage of pregnancy, may pass through the disease without miscarrying; and, that when miscarriage does occur, it is not necessarily fatal to either the mother or the infant. He collected 160 cases, of which 71 aborted, 13 died, and 147 recovered. In seven patients of his own, who were confined during an attack of typhus fever in the ninth month of pregnancy, two died of puerperal fever and five recovered, while all the children were alive and did well. Murchison also points out that, notwithstanding the supposed prejudicial influences of pregnancy and suckling, the mortality was less in females than among males at every period of life above fifteen.

These facts are in remarkable contrast to those in connection with relapsing fever, which was supposed by some to be but a mild form of typhus fever, for in the former 'abortion is almost invariable and the fœtus dies; whereas in the latter abortion is the exception, and when it occurs the child, if near full time, usually lives.'

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* *Loc. cit.*, p. 212.

Treatment.—The treatment calls for little special remark. Typhus fever not being usually accompanied by any putrid discharges, there is little, if any, increased risk of septic infection. It is a 'sthenic' disease, so that labour is likely to be accomplished by natural means alone, and usually with little delay. Post-partum hæmorrhage is said to occur with relative frequency, and must be treated in the usual way. If delay in labour occurs, there need be no hesitation in applying the forceps.

CHAPTER V

ORGANIC AND FUNCTIONAL DISEASES IN PREGNANCY

i Acute Yellow Atrophy of the Liver ii Chorea iii Diabetes Mellitus—Nephritis v Cardiac Disease; Mitral Stenosis; Aortic Regurgitation; Mitral Regurgitation; Combined Mitral and Aortic Lesions vi Hyperemesis Gravidarum vii Eclampsia.

i ACUTE YELLOW ATROPHY OF THE LIVER

This condition is characterised by the rapid onset of illness, which soon develops into the typhoid state with muttering delirium usually followed by coma and death. Moderate jaundice appears early, and continues; vomiting is usual and the vomit may contain blood,—bleeding from other parts may also occur; and fever may be high or absent. The liver is painful and tender, and a daily diminution in its size may be noted. The urine is scanty, high coloured, and of high specific gravity, urea is diminished or absent, and bile pigment, bile acids, and crystals of leucin and tyrosin are found in it. The average duration of the disease is one week.

Little is known of the cause of acute yellow atrophy. It is believed to be a toxæmia due to some micro-organism, but none has as yet been isolated. Seventy per cent. of cases occur in women, and of these fifty per cent. are pregnant. If pregnant, the patient usually miscarries.

An interesting record of six cases is given by Giffard of Bombay.* In all, the symptoms and signs were well marked, and, in those in which a *post mortem* examination was made, the diagnosis was confirmed. The following table gives the important details of these cases:—

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* Appendix to Report of Rotunda Hospital, 1901-1902, *Trans. Roy. Acad. of Medicine in Ireland*, 1903.

	Age.	Preg.	Period.	Labour.	State at Time of Labour.	Result.	Duration of Disease.	Fœtus.
I	24	2nd	7th month	induced	unconscious	death in 2 days	5 days	dead
II	36	3rd	9th ,,	,,	,,	death in 13 hours	?	,,
III	28	3rd	9th ,,	accelerated	conscious	death in 2 days	? 4 days	living
IV	25	2nd	8th ,,	,,	comatose	death in 4 hours	?	? dead
V	26	1st	8th ,,	natural	drowsy	death in 12 hours	?	dead
VI	18	1st	8th ,,	extraction	conscious	death in 3 days	4 days	alive

In three of these cases, a *post-mortem* examination was made. In one case the liver was reduced to twenty-two ounces in weight, in a second case to fifty-two ounces, and in a third to twenty-five ounces.

Treatment.—No special treatment is known to have any beneficial effect. The only thing that can be done is to endeavour to maintain the patient's strength. Labour should be induced if it does not come on spontaneously, and its course should be accelerated as much as possible.

CHOREA

The combination of chorea and pregnancy is important from several points of view, and deserves more attention than is usually given to it. Chorea is nearly three times more frequent among females than males, and, among predisposing and exciting circumstances, menstruation, pregnancy, and anæmia are well marked. Still, it is a rare complication of pregnancy. Barnes, in 1868, collected fifty-six cases from all sources; Fehling, in 1874, collected sixty-eight cases; Charpentier found only two cases out of 1,600 deliveries at the Clinique; and, in the Rotunda Hospital statistics, no case is noted in 20,000 deliveries. A considerable proportion of cases occurring in pregnancy have a clear history of a previous attack. Fifteen out of the fifty-six cases quoted by Barnes* have this history definitely noted, and in several others there is no report to indicate whether there had been a former attack or not. All observers who have inquired into the subject are agreed that chorea occurring in early life has a strong tendency to reappear in pregnancy, though fortunately it does not always do so. When it does, it appears in the great majority of cases in the first pregnancy, but has been delayed to the second or even to the third. Chorea may also occur for the first time during pregnancy. It does not necessarily reappear in successive pregnancies, though it sometimes recurs in some or in each of the succeeding pregnancies. In no small proportion of cases (10 out of 56—Barnes), it has ceased during the course of pregnancy, but, as a rule, it continues till delivery. It may then cease with the pregnancy, or may continue for an indefinite time after. Very rarely (2 cases out of 56—Barnes) it comes on just after delivery.

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* *Obstet. Trans. Lond.*, vol. x.

The death of the mother as a direct result of the chorea is sufficiently frequent to place the disease amongst the very serious complications of pregnancy. Barnes found seventeen deaths in fifty-six cases; Spiegelberg found twenty-three deaths in eighty-four cases; and Wenzel places the mortality at 27·3 per cent. Abortion or premature labour is also common, and occurred in eighteen out of fifty-six cases. As the expulsion of the ovum most frequently occurred before the child became viable, or, when viable, after its death, it will be seen that the fœtal mortality is also exceedingly high. In view of the fact that the maternal mortality is much higher than the mortality that obtains amongst non-pregnant cases of chorea, Buist* has pointed out that, in a considerable number of cases, death was due to associated conditions such as eclampsia and sepsis. Nevertheless, if chorea predisposes to such associated conditions, its gravity remains.

As has been already mentioned, the fœtus often dies *in utero*, and is thus a cause of premature labour. It may, however, reach full term, and is then often well developed and healthy, but it may, on the other hand, be weakly and ill-nourished, and so may not long survive its birth. In a few cases, the child has been known to develop chorea early in childhood, and in one case was born with choreiform movements which persisted throughout life (Mayo).

Chorea most frequently makes its appearance during the first half of pregnancy, most commonly about the third or fourth month. Of fifty-seven cases, twenty-two began during the first three months, twenty-three during the second three months, and only twelve in the last three months. On the whole, the pregnant condition appears to aggravate chorea. In some cases, no doubt, the symptoms remain mild throughout, and, as has been mentioned, may even disappear, but, in the majority of cases, the symptoms appear to be much more severe than in a corresponding proportion of ordinary non-pregnant cases. The movements are frequently so continuous that the patient is worn out for want of sleep and prostrated from sheer muscular exhaustion, and they may be so violent that she falls out of bed, unless she is constantly held down. Speech and even deglutition may be interfered with by spasm of the muscles about the mouth and pharynx, and respiration may be so erratic and spasmodic that cyanosis is produced. In the worst type of case, the mind becomes dull, delirium comes on, and coma follows. In some cases, mania or other form of mental disorder develops during the progress of the case, and this condition may persist after delivery or may be recovered from when the pregnancy or the chorea terminates, or, on the other hand, may cause a fatal termination.

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* 'Chorea in Pregnancy,' *Edin. Obstet. Trans.*, 1894-5.

Chorea has a distinct tendency to provoke labour. This may be explained by the profound disturbance of the nervous system which it causes; by interference with the functions of the body, and, amongst these, with that of respiration, as the proper aeration of the blood is prevented, and the latter also becomes overloaded with carbonic acid from the increased muscular action; and by the general impairment of nutrition following these conditions.

The condition of the urine in chorea is similar to that with which we are familiar in febrile states. It has a deep colour and heavy odour, a high specific gravity, and there is great deposit of urates. Later, it may become alkaline with a considerable excess of phosphates and urea. Todd, Beale, and Bence Jones made special researches into the urine in chorea, but, further than establishing that the above conditions were the rule, and that the occasional appearance of albumin and sugar had no direct relation to the chorea, they found no definite characters peculiar to the disease, or throwing any light on its origin.

Treatment.—The treatment of these cases should aim at the very outset at curing the chorea. For this, rest and freedom from anxiety are essential. The administration of iron, zinc, strychnia, or bromide of potassium has been recommended, but the best results are perhaps obtained from arsenic, beginning with a small dose—three minims of Fowler's solution well diluted, and rapidly increasing it up to ten minims, or even more, three times a day, after food. As soon as itching of the eyelids or diarrhœa appear, no further increase is made, and, if these symptoms increase, the dose must be reduced or even the drug stopped for a time. The drug should, however, be given as continuously as possible until the symptoms abate, when the amount is gradually reduced. If the case is severe and will not yield to drugs, it may be necessary at times to use chloroform to give the patient some rest from the continuous and violent movements. Opium, morphia, and other sedatives have been frequently tried, but with disappointing results. Even after chloroform, it has been sometimes observed that the movements come on with much greater vigour than before, as soon as the effect of the drug has passed off. Digital or mechanical dilatation of the os, may perhaps be tried, as, in a case related by Wade, digital dilatation of the os cured the chorea, without interrupting the pregnancy, which continued to term.

In these cases, one must be on the alert for any signs of threatening mental impairment or mania, for any indication that the strength of the patient is failing, or for evidence that the convulsions are increasing in frequency and force. Under such circumstances, the induction of premature labour is indicated. It is remarkable how rapidly grave symptoms come on, and, as the induction of labour takes some little time, it is well not to postpone active treatment until the last moment, as it may then be too late to save the patient's life. Induction of labour does not always bring about the termination of the chorea, but it most frequently does so, and in such cases the prognosis is good. If, on the other hand, the symptoms continue after labour, the prognosis is unfavourable. The best method of induction is that which involves the least irritation and disturbance of the patient, and leaves labour as much as possible to Nature. For this reason, Krauze's method of inducing labour by passing an elastic bougie between the membranes and the uterine wall, is perhaps the most suitable. Once labour has set in, and the uterine orifice has become fully dilated, there is usually no delay nor further trouble, the child being as a rule expelled by the natural efforts. Should there, however, be any delay, or appearance of exhaustion on the part of the mother, labour should be completed as rapidly as possible by the forceps. Owing to the choreic movements, considerable difficulty may be experienced in any necessary manipulations. Chloroform, however, is well borne, and should be pushed far enough to keep the patient quiet.

DIABETES MELLITUS

It is well known, since the researches of Blot* in 1856, that towards the end of pregnancy and during lactation, a small quantity of sugar can generally be easily found in the urine; this has been called galactosuria or resorption-diabetes. It is not considered a disease or an abnormal condition, and must not be confounded with true diabetes, to which alone we at present refer. Matthews Duncan stated that in the Edinburgh Maternity, when verifying the French researches, he had found traces of sugar in the urine of every nursing woman, and that it was a natural physiological condition which had not been shown to have any relation to the disease diabetes.

The occurrence of diabetes in pregnancy is rare. In the first place, the disease is not a very common one; and in the second place, the debility caused by it is usually so great, that, as a rule, the sexual functions, including menstruation, are arrested. It is known that in the male, at least, sexual power is, as a rule, early lost, and it is probable that a similar consequence also occurs in the female. There are notable instances, however, which prove the retention of sexual potence. Seegen mentions that he has seen regular menstruation up till death in cases of severe diabetes, and several cases are on record of diabetic women having had successive pregnancies without any interruption of the disease. It is therefore probable that the combination is not quite so rare as it has been considered to be. It is remarkable how little attention has been drawn to it in text-books, journals, or hospital reports, and it is quite possible that cases escape detection because they are not looked for. Frerichs says that of 386 diabetics under his own care, 104 were females, and, of these, only one was pregnant. Griesinger found only two pregnant cases amongst fifty-three female diabetics. Stengel* has recently collected from all sources nineteen cases, amongst which twenty-seven pregnancies attended with diabetic symptoms occurred.

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* *Gazette des Hopitaux*, 1856.

The recorded cases show that pregnancy may occur in a diabetic woman, or that diabetes may commence during pregnancy, and continue. Diabetes may also occur only during pregnancy, as in the remarkable case recorded by Bennewitz, in which a woman, aged twenty, was diabetic only while pregnant, and at other times was healthy; or, on the other hand, after the cure of diabetes, pregnancy may take place without the recurrence of the disease. From Stengel's investigation of nineteen collected cases, it would appear that, when diabetes complicates pregnancy, it is usually in the case of a multipara, as only three of these patients were primiparæ.

Diabetes is undoubtedly a very grave complication of pregnancy, maternal death having occurred at the time of labour, or within a few weeks, in ten out of nineteen cases. Abortion occurred in six of the twenty-seven pregnancies, and in eight the fœtus was born dead or died shortly after birth. The child is often of very large size, this sometimes being due to anasarca, and in one case it was born with diabetes. Hydramnios is common, and sugar has been found in the amniotic fluid. Death may occur soon after the onset of labour, or, more commonly, very soon after delivery. It is usually due to coma, probably induced by the anxiety and fatigue of labour. Sometimes, though much more rarely, death occurs suddenly from collapse, or cardiac syncope, or from an associated phthisis. Seegen records the case of a patient who, during the continuance of diabetes, conceived three times, and always miscarried about the middle of pregnancy—dying at the last miscarriage. Pregnancy may continue to term, but the onset of premature labour is the rule, probably due to the death of the fœtus.

Treatment.—The general treatment of these cases is similar to that of diabetes occurring in non-pregnant women, and should be careful and unremitting, special care being taken that the patient is not subjected to mental worry, and is not allowed to undergo fatigue of any kind. Apparently, from the cases recorded, no fixed rule can be laid down as to the treatment of the pregnancy. As we have said, the latter may terminate normally both for mother and child, or it may terminate fatally for the child without any warning and without any ill effect on the mother. It may sometimes be necessary to induce premature labour, either for the sake of the mother or of the child, but the indications are not plain, and the result is not promising. Schauta* considers that, in diabetes, pregnancy ought to be interrupted, on account of the high rate of mortality in both mother and child, but as he appears to favour this line of treatment for so many complications of pregnancy, one is inclined to discount his recommendation. In a case recorded by Matthews Duncan premature labour was induced on the sudden appearance of alarming symptoms of maternal collapse, but the child was born dead and macerated, and the operation did not save the mother. Labour may be induced for the sake of the child, either on account of the impending death of the mother, or when the experience of former pregnancies showed that the child, though reaching a viable age, died before labour came on.

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* *Univ. of Pennsylvania Med. Bulletin*, October, 1903.

In the management of labour itself, undue delay must be avoided, and if little progress is being made, delivery should be hastened either by turning or by the application of the forceps. As a rule, however, labour is easy and not prolonged. A moderate degree of chloroform anæsthesia is not contra-indicated. During the progress of the case, it is necessary to remember that a large amount of urine is being excreted, and that the bladder will require to be frequently emptied, if necessary with a catheter. The medical attendant must also remember that the onset of coma may occur in some cases.

NEPHRITIS

The relation of nephritis to pregnancy has received more attention from obstetricians than any other subject of general medicine, on account of the connection of this disease with eclampsia. As the milder degrees of nephritis are only recognised by the presence of albuminuria, we must discuss the subject under this symptom, irrespective of the fact that it is possible to have albumin in the urine, without any definite inflammatory change (nephritis) in the kidney.

Frequency.—There is such a wide difference of opinion amongst observers as to the frequency of albuminuria in pregnancy, that one can only suppose that there is a difference in the standard taken as to the amount or persistence of albumen that is considered pathological, or to the method of testing employed. Dumas, from an examination of the statistics of several observers, considers that albuminuria occurs in one out of every five or six pregnant women, Gillette in thirty per cent., Barker in four per cent., and Parvin in six per cent. of cases. Albuminuria is very frequently met with in twin pregnancies. It is more frequent in primiparæ than multiparæ, and more common in the late than in the early months of pregnancy.

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* Report Fourth Internat. Cong. Gynæcol., 1902.

Ætiology.—A woman, the subject of chronic nephritis, may become pregnant, or a pregnant woman may become the subject of ordinary acute nephritis from any of the usual causes of that condition. Other cases also occur which require a different classification, and amongst these two forms of renal disease are recognised:—(1) The kidney of pregnancy (Leyden) characterised by the symptoms of sub-acute nephritis coming on in the later months of pregnancy, persisting throughout it, and usually passing off after delivery, not to recur; and (2) the relapsing kidney of pregnancy, in which albumin and casts are found from the early months of pregnancy, disappear after delivery and return with each subsequent pregnancy. Several theories have been brought forward to account for these conditions, and of these the following are the most important:—

(1) The increased work thrown upon the kidneys by pregnancy, associated with a direct irritation or inflammation of the kidney, the result of an altered condition and greater impurity of the blood.

(2) Pressure on the renal veins by the enlarged uterus and consequent venous congestion of the kidneys—a condition analogous to the congestive albuminuria of cardiac disease.

(3) Pressure of the uterus on the ureters.

(4) Anæmia of the kidney caused by spasm of the renal vessels produced reflexly by stimuli from the genital organs (Duhrssen and Spiegelberg).

(5) Anæmia of the kidney due to blocking of the renal vessels by minute emboli, either resulting from some ferment in the blood which causes coaguli to form, or coming from the placenta.

Pathological Changes.—In ordinary acute or chronic nephritis occurring during pregnancy, the histological changes in the kidneys do not differ in any way from the changes that occur in the non-pregnant state. In the kidney of pregnancy, the organ is enlarged, and pale; the capsule strips readily, but small particles of renal substance adhere to it; the cortex is swollen and anæmic; and the medullary portion is often congested. The epithelium of the tubes becomes swollen, granular, and shows fatty degeneration; there is very frequently an infiltration of small round cells about the glomeruli, particularly around the 'neck,' where the vessels enter; and, when this is present, desquamation of the glomerular epithelium is seen. Here and there in the connective tissue, a similar infiltration of small round cells is seen, which press on the blood vessels.

Symptoms.—The symptoms are those of Bright's disease varying in degree—namely, probable anasarca, albuminuria, tube casts in the urine, and a probable change from the normal in the quantity of urine passed. In very chronic nephritis, the quantity is usually increased, but more frequently, as in sub-acute or acute nephritis, or in the nephritis of pregnancy, the urine will be found to be diminished. In chronic cases, there is cardiac hypertrophy with high tension pulse. Nephritis is decidedly aggravated by pregnancy, and so all its symptoms become more marked. Thus, a local œdema may go on to a general anasarca, with effusion into the serous cavities; the urine tends to diminish steadily in quantity, with increase of albumin, higher specific gravity, and diminution in the total quantity of urea; the digestion becomes disordered, and headache and vomiting (early uræmic symptoms), weakness and inability to exercise, disturbance of vision—dimness or amaurosis, and drowsiness and mental obscuration may occur; and, finally, twitchings of muscles or limbs, going on to actual convulsions, and ending in coma and death. During some stage in this sequence of events, it is probable that the pregnancy will terminate prematurely, usually preceded or accompanied by the death of the fœtus. Of these symptoms, the most important, from a prognostic point of view, are the steady diminution in the quantity of the urine, and the eye symptoms. Both eyes are, as a rule, affected, although often not equally so; vision is much lowered, and even perception of light may be wanting. 'Blindness is not always due to organic changes in the retina, and is often largely the result of uræmia' (Swanzy). The changes seen with the ophthalmoscope are, venous hyperæmia, swelling of the papilla and of the retina in its neighbourhood, hæmorrhages into the retina, and white spots in a zone around the papilla.

Eclampsia is not specially liable to occur in true Bright's disease, a fact which has given observers cause to seek for some other explanation than renal disease for this serious condition, but is more commonly found in association with the kidney of pregnancy. The opinion is held more generally now than formerly, that the nephritis is not the cause of the eclampsia, but that both nephritis and eclampsia are merely the expression of some existing intoxication. The condition of the kidneys is important, however, in that, by an examination of the urine, its quality, amount, specific gravity, and sediment, we have a tolerably reliable method of estimating the danger of the onset of eclampsia.

In the so-called relapsing kidney of pregnancy, the symptoms closely resemble those of acute Bright's disease. They come on early in pregnancy, continue throughout it, and disappear when it terminates, to re-appear in each succeeding pregnancy. The fœtus usually dies, and eclampsia is rare, though urgent symptoms may arise, as in other forms of nephritis.

Treatment.—The routine examination of the urine in every case of pregnancy should be carried out as soon as the patient comes under observation. If albuminuria is found, treatment should be adopted at once, and continued either until the urine remains free from albumin—a rare but possible event, or until the case passes out of the obstetrician's hands. If there is no symptom of nephritis other than albuminuria, it will be sufficient to advise that the dietary should consist of light food with very little meat, except that of fowl and fish, once daily, no soups nor meat extracts, nor alcohol. The bowels should act at least once a day, otherwise a simple purgative, such as a compound rhubarb pill or a drachm of the liquid extract of cascara sagrada, should be taken.

When, from previous experience of the patient, we expect that nephritis will come on as the period of pregnancy advances, more rigid prophylaxis should be employed, the diet being practically restricted to milk and farinaceous foods, and the bowels not only made to act daily, but purged once or twice a week. For this purpose, one and a half drachms of Pulv. Glycyrrhizæ Co. or two ounces of Mist. Sennæ Co. may be given.

When definite symptoms of true nephritis are present, we cannot hope for a cure, and so must be satisfied either to ameliorate them, if we can, or to prevent their increasing in number and severity. The quantity of urine passed daily must be accurately measured and recorded, as an important index of the progress of the case. Milk must be the principal diet. Tarnier, indeed, advises that it should be the sole food and drink, beginning the treatment by gradually diminishing other food and increasing the quantity of milk, till as much milk as possible, *i.e.*, up to four quarts daily, is taken, and no other food or drink. Few patients can tolerate this, however, and it is more usual to allow milk puddings, cornflour, eggs, vegetables, and fruit—but little or no meat, and that chiefly chicken and fish. Broths, meat extracts, and alcohol are to be strictly avoided. The more severe the case, the less food, other than milk, is allowed. Any continuous diminution in the amount of urine calls for restriction of diet, and cathartic action of the bowels by a saline draught such as one or two ounces of Mist. Sennæ Co. Another safe and reliable hydragogue purgative in such cases is one drachm of Pulv. Jalapæ Co. Diuretic action may be induced by five to ten minim doses of the tincture of digitalis in mixture, or by the powdered leaves combined with mercury and squill (gr.i.ss. of each), in a pill, given three times a day. If there is no improvement, the patient must be kept in bed on a diet of milk alone, and be freely purged. If further diuresis is required, she should be placed in a hot pack for half an hour, an hour, or two hours, according as it is seen that free diaphoresis is induced, and that the patient appears comfortable and quiet, and does not show signs of distress or weakness. Other means of inducing diaphoresis are drugs, hot-vapour baths, and hot-water baths, but they do not appear to us to be as reliable or as easily managed as is the hot pack. The symptoms which point to extreme urgency are threatened suppression of urine, threatened cardiac failure, severe dyspnœa, constant vomiting, mental obscuration, eye symptoms such as marked amblyopia or amaurosis, marked albuminuric retinitis, or retinal hæmorrhages;

and, in the presence of these, the question of undertaking the induction of labour must be considered. If such a course is to be adopted, it should be carried out with the least possible delay.

The chief point, so far as the obstetrical treatment of the case is concerned, is the question of the induction of premature labour, and on this point there is great diversity of opinion. Pregnancy has a distinctly unfavourable influence upon chronic Bright's disease, and, for this reason, some writers recommend that in a well-marked case early abortion should be brought about, in order to save the mother from the almost certain aggravation of symptoms and the possible increase in the disease. Hoffmeier, after a very careful consideration of all the bearings of such cases, has come to the conclusion, that, in chronic nephritis, pregnancy should be interrupted artificially in the interests of the mother, when, in spite of suitable treatment, the symptoms of the disease become worse, or even when they do not improve. This view is the more easily accepted when we remember that the fœtal mortality amounts to 50 or 60 per cent.

If the operation is to be successful in saving the life of the mother, it must be undertaken before her condition has reached such a state that there is almost complete suppression of urine, and threatened uræmia. It is necessary to carefully watch the case, and to induce labour without delay if it is seen that, in spite of treatment, the symptoms are tending to this termination.

In nephritis due to pregnancy, symptoms arise as a rule in the later months, and the induction of labour is seldom required. Pajot is of opinion that labour should never be induced in the kidney of pregnancy, as he considers the operation more dangerous than eclampsia itself. Hoffmeier, however, considers that in view of the danger of eclampsia, artificial interruption of pregnancy is indicated if, in spite of suitable dietetic treatment, the symptoms steadily become more serious. With this view we agree, as, in such cases, if pregnancy does not come to an end, the death of the patient is almost certain.

Prognosis.—Nephritis is one of the most common causes of recurring death of the fœtus *in utero*, and is also most dangerous to the life of the mother. Apart from the consequences of eclampsia, sixty per cent. of children are lost in nephritis, either by death *in utero* or by premature delivery before viability.[*] Hoffmeier places the maternal mortality of nephritis alone at thirty-three per cent. This, he admits, is probably too high, many of the cases being severe ones, and sent to the public hospital on that account. Still, the mortality is very high, and the earlier the symptoms of disturbed compensation the higher it becomes. It is probable that it is higher than even statistics show, for the evil effect of pregnancy on the nephritis does not end with labour; the pregnancy has reacted on the whole renal and vascular system, and may have a remote and fatal effect beyond the period which would be included in obstetrical statistics.

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[*] Internat. Cong. Gynæcol., 1902.

[†] Hoffmeier, *loc cit.*

It is difficult to say what is the mortality resulting from the kidney of pregnancy, as statistics usually deal, not with the condition itself, but with the associated eclampsia. The occurrence of eclampsia is relatively frequent in this form of nephritis, and in the former the mortality varies from twelve to thirty per cent.

CARDIAC DISEASE

The relation of cardiac disease to pregnancy is, as a rule, very inadequately dealt with in English works on obstetrics. Angus MacDonald's monograph, published as long ago as 1877 in the *Obstetrical Journal*, is still perhaps the most valuable contribution on the subject, and he, at that time, complained of the scant manner in which cardiac disease was dealt with by writers on obstetrical subjects, and the complaint is still justified.

Text-books on midwifery nearly all mention organic disease of the heart in relation to pregnancy, but these references are usually vague and general, and, as a rule, no attempt is made to differentiate between the different forms and their special effects on pregnancy and parturition. It is only by such considerations, however, that we can form any intelligent estimate of the additional risks that pregnancy and parturition impose, and of the measures we must adopt so as to avoid or diminish such risks.

We may here confine ourselves to the consideration of the effects of valvular lesions of the heart, and only those of the left side need be dealt with. Further, aortic stenosis by itself is so rare, that it may be ignored, and consequently the varieties that must be considered are the following:—Aortic regurgitation, alone or combined with stenosis; mitral regurgitation; mitral stenosis; mixed aortic and mitral lesions.

We propose to first discuss the general relations of cardiac disease to pregnancy and its treatment, and then to discuss the particular consequences and treatment of the different forms of valvular disease.

Larcher, in 1825, was the first to point out that during pregnancy under normal conditions the heart hypertrophies, in consequence of the increased work it has to do, and the larger vascular area it supplies. This hypertrophy is for the most part confined to the left ventricle, as although the needs of the fœtus throw increased work on the pulmonary circulation also, the latter is not so greatly increased as to call for a marked hypertrophy of the right ventricle. It has been suggested that the involution of the heart after pregnancy may not be so complete that it returns to its original condition, and that thus, repeated pregnancies, especially if they recur rapidly, may induce a condition of persistent hypertrophy. It is conceivable that this may in some cases occur, and, if so, it is possible that this may change the diameter of the mitral or of the aortic orifice, or of both, and thus lead to insufficiency, without any other morbid condition. Such an occurrence must, however, be extremely rare.

It is easy to understand how the occurrence of pregnancy causes a rapid development of the symptoms of a hitherto latent cardiac lesion. The enormous and rapidly increasing area of the uterus with its decidual and placental vessels, together with the increasing quantity of blood, give the heart an increased and increasing amount of work. If, before pregnancy, the heart had a leaking or stenosed valvular opening, it hypertrophied to compensate for this; but now it is called on to hypertrophy still more, and militating against its ability to do so is the fact that the nutritive quality of the blood is inferior and daily becomes more so, as it carries the fœtal as well as the maternal impurities. In addition to this, the freedom of action of the heart is becoming impeded by pressure due to the increasing size of the uterus, so that the excursions of the diaphragm are less free. This pressure not only displaces the heart upwards, but limits the full expansion of the lungs, so limiting their oxygenating power on the blood. Hence it is that the compensating power of the heart rapidly fails, when, to a valvular lesion, is superadded the increased strain of pregnancy. We are aware that Dohrn, Küchenmeister, and others have maintained, as the result of their measurements and experiments, that the total capacity of the lungs of the human female is constant throughout normal pregnancy. Still, it is difficult to believe this, as the increased frequency of respiration, its shallowness, and the ease with which dyspnœa comes on, all point to a limitation of the capacity and the expansion of the lungs. However, whatever may be the condition in health, there is no question that the upward pressure of the diaphragm has an injurious effect on a damaged heart.

The time at which the symptoms of failing compensation manifest themselves, and the rapidity with which they develop, depend on the degree of the valvular lesion and the previous condition of health of the patient. In a first pregnancy, these symptoms may not at any time become urgent, but they seldom fail to become so in a subsequent pregnancy. The usual period at which they manifest themselves is just about the mid-term of pregnancy, that is, about the fifth month. As the case progresses, the woman may die from the effects of the cardiac lesion during pregnancy, premature expulsion of the ovum may occur, or pregnancy may continue. If she reaches full term, labour may prove fatal. Even after labour has been successfully accomplished, it is not uncommon for the mother to die, within a few days, weeks, or even months, as a late result of the association of pregnancy and heart disease.

Various explanations have been offered of the relatively frequent premature expulsion of the ovum in cardiac cases. In some cases, it appears as if venous congestion leads to dilatation of the placental vessels with rupture and separation of the placenta. In others, the onset of labour appears to be due to cyanosis, which causes the stimulation of the uterine centres by the accumulation of CO_2 in the blood.

General Treatment of Cardiac Lesions.—The treatment of cardiac lesions commences, not with the period of gestation, but on the first recognition of a cardiac lesion, whenever that may be. A woman known to have cardiac disease should be carefully watched for the slightest indication of commencing failure of compensation, if there is any likelihood of her being pregnant. If symptoms appear, she should be confined to bed, and digitalis or strophanthus administered until compensation is again established. In any case, even though no cardiac symptoms are present, her general health should be diligently watched, the bowels kept open, and rest enjoined. If she becomes pregnant, these precautions are doubly important. Should failure of compensation occur in spite of all precautions, and the symptoms increase in gravity, the medical man must be prepared to bring the pregnancy to an end at any time if it is found to be necessary to do so. The question of the propriety of inducing labour in cardiac disease is a difficult one, and is still unsettled. Jardine says:-- 'The results from induction are so bad, that I am inclined to question the propriety of doing the operation. The risk is exceedingly great. In a bad case, I should advise the induction of abortion before the fourth month, *i.e.*, before the extra strain has begun to tell on the heart, but in the later months I should be very loth to interfere.' The general teaching of text-books also is against inducing labour, our examination of isolated and collected cases tends to support this teaching, and MacDonald definitely held the same opinion. There have been, however, great advances since MacDonald's time, in the methods of inducing labour and of rapidly emptying the uterus, and in the future, as experience is gained, these may enable us to take a less pessimistic view of a treatment which appears in some cases to give the only possible hope of relief.

Our own views on the treatment of cardiac cases may be briefly summed up as follows. 1. If the symptoms of the patient are slight, and we have reason to believe that sufficient compensation will occur to carry her safely through pregnancy, the latter should be allowed to continue. 2. If the patient is seen at an early stage of pregnancy, while the heart is still working properly, but from her history we have reason to believe that its ultimate failure is probable, labour should be induced before any symptoms of failing compensation appear. 3. If, on the other hand, the patient is not seen until marked cardiac symptoms have occurred, attempts should be made to restore compensation. If these attempts are successful, labour should then be induced, lest a recurrence of the symptoms should occur, with probably fatal consequences.

Similarly, if our efforts at restoring compensation fail, the condition of the patient is desperate, and the induction of labour should still be carried out, as it affords a small hope, whereas if pregnancy is allowed to continue there is none. The evil results of leaving cardiac cases until the severity of the symptoms induce spontaneous delivery is seen in the fact that of fourteen cases recorded by MacDonald and Gardiner in which premature delivery came on, only three recovered, and these were cases of aortic disease.

Whether labour is induced or comes on at full term, it should be terminated as rapidly as possible. Digitalis or strophanthus and stimulants may be freely given; anæsthetics are well borne, and should be used; if there is the least delay in progress, the os should be artificially dilated by Bossi's or Frommer's dilator, and the child extracted with the forceps. In the third stage of labour, the loss of a certain amount of blood is advisable, and, consequently, active measures to prevent a loss need not be at once taken. If the uterine hæmorrhage is scanty, and there are signs of cardiac engorgement, a vein should be opened in the arm. If there is great œdema of the vulva, the labia may require to be freely punctured at the commencement of labour with strict antiseptic precautions, and allowed to drain into sterile dressings. Strychnine ($\frac{1}{30}$ gr.), with digitalin ($\frac{1}{100}$ to $\frac{1}{50}$ gr.), given hypodermically, will be found serviceable in combating the cardiac weakness, and in aortic cases Nitrite of Amyl may prove of use in lowering the blood-pressure and relieving the strain on the heart.

The nursing of the infant should be prohibited in even the mildest cases. The call it makes on the strength and nutrition of the patient is most injurious to the heart in its endeavour to recover from the strain of pregnancy and parturition, and to regain its full compensation.

Prognosis.—The following table shows the results of 28 cases, which MacDonald has met with himself or collected from various trustworthy sources:—

Nature of Lesion.	Number of Cases.	Deaths.	Percentage.
Mitral stenosis	12	9	75
Mitral regurgitation	8	3	37·5
Aortic regurgitation	5	2	40
'Dilated weak heart' ..	1	1	100
'Plastic endocarditis' ..	1	1	100
Ulcerative endocarditis ..	1	1	100
Total	28	17	60·7

Thus, in twenty-eight cases there were seventeen deaths, or 60·7 per cent., and of these seventeen fatal cases, ten were primiparæ. 'This,' as MacDonald says, 'in cases presenting no purely obstetric cause likely to lead to increased mortality, leaves it beyond question that the combination (of pregnancy and cardiac disease) is extremely liable to prove fatal.'

Jardine* has given carefully detailed notes of thirteen cases in his own practice, and from these and others which he has observed he draws valuable conclusions as to management. In the reported cases, he was very fortunate in losing only one patient, though several patients had mitral stenosis.

The most serious lesion appears to be mitral stenosis; after that aortic regurgitation; and then mitral regurgitation, alone or combined with stenosis or an aortic lesion.

Finally, the question must be answered, Should a woman with valvular disease marry? The answer to the friends or relatives of the patient must be 'No.' Our advice will probably not be taken, but, all the same, it should be given, and none the less definitely on that account. There is no use in 'hedging' by saying that, if failure of compensation has ever occurred, or if the damage to the valve is considerable, or if some particular valve is involved, she should not marry. In view of the sequence of events which we know to be usual in any case of valvular lesion, and remembering that a woman has duties as a wife and as a mother which require her health and strength for their due performance, there should be no hesitation in the mind of the physician as to what answer he would give to such an enquiry.

It is astonishing how frequently the question is raised in text-books, and how evasively it is answered. That 'the perils of marriage should be clearly stated to both the contracting parties,' as advised by a very recent American treatise on 'The Heart,' is not the way out of the difficulty. The physician has many puzzling questions to answer, but this is not one of them, and, as his opinion has been asked, it should be given in a definite and unequivocal manner.

Mitral Stenosis.—As is well known, mitral stenosis is more commonly met with in females than in males, though the reason is not obvious. Its onset is very frequently insidious, no history of an attack of rheumatism being forthcoming, although generally vague, but slight, pains have been noticed in the joints. The subjects of mitral stenosis are usually thin, anæmic, and weakly, and suffer from cold extremities. They seem to have less blood than normal—the stream passing through the narrow mitral opening only affording a small volume for the ventricle to send on at each systole. It is probably for this reason that these patients make such a poor fight during pregnancy.

Urgent symptoms most frequently arise in the second stage of labour, and call for prompt measures. These symptoms are irregularity of pulse, cyanosis, and threatening or actual syncope. It is the 'bearing-down' of this stage that so increases the danger. During this time the lungs are tensely filled with air, the glottis closed, the diaphragm depressed, and the whole muscular system, including the uterus, in a state of strong contraction. In consequence, the blood from all these parts is driven into the veins, and thus thrown upon the already overloaded, overworked, and exhausted right heart. The narrowed mitral opening does not allow this blood to be freely passed on, and the left auricle and the right heart become overdistended. From this cause, paralysis may occur, and not, as Fritsch has explained, from a sudden influx of blood entering the chambers of the heart when in a state of emptiness. The fall in blood-pressure which occurs, and which MacDonald demonstrated by tracings, is thus explained by the distended left auricle, with its weakened pulsations, being unable to send on enough blood through the narrowed mitral orifice to supply the left ventricle. Hence, comes the irregular flickering pulse and the increasing cyanosis bringing about a gradual, but finally profound, narcosis, which will end in death if not interrupted.

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* *Journal of Obstetrics*, 1902.

Such a train of symptoms appears to forbid the administration of chloroform, but several recorded cases go far to prove the contrary. A moderate degree of chloroform narcosis lessens or does away with the bearing-down efforts, which, as we have seen, have such an evil effect. The labour may then be ended by the application of the forceps.

On the completion of the second stage, the sudden limitation of the vascular area by the cessation of the placental circulation and the contraction of the uterus, causes an increased quantity of blood to be rapidly thrown on the right side of the heart, and this may become so dangerously embarrassed in its already weak and distended condition, that its systole may fail and sudden death occur. Berry Hart has published such a case. Death occurred suddenly after delivery, and *post-mortem* examination showed the right side of the heart to be enormously distended and full of blood. This suggests a line of practice which is advocated by Hart, and warmly supported by Jardine in the paper to which we have already referred—viz., that at the time of labour rather free hæmorrhage from the uterus should be encouraged, so as to ease the heart, and prevent engorgement. If the uterine hæmorrhage is not sufficient for this purpose and cardiac embarrassment begins to appear, venesection at the arm should be undertaken without delay. Acting on these lines, Jardine has had remarkable success. Of his thirteen reported cases, three were mitral stenosis, and three combined mitral stenosis and regurgitation. All six made an excellent recovery, though some of them were very serious, and required artificial aid in delivery or the induction of labour.

When labour is over, a hypodermic injection of morphia is of material aid to the patient. Morphia acts as a stimulant to the heart, it quiets down the whole system, and it gives the patient a much-needed rest, after the exhaustion and anxiety of labour.

The administration of digitalis and strychnine is also usually essential in the after-treatment of the case.

Aortic Regurgitation.— Aortic regurgitation is, for several reasons, much more common in men than in women, and though met with at all ages, it is usually found in the latter half of life, since its chief cause is degenerative change in the aorta or its valves It is therefore a comparatively rare complication of pregnancy.

The danger arising from this condition is most marked from the mid-term of pregnancy till the completion of the second stage of labour. The increase in the blood quantity and blood-pressure during pregnancy tends to increase the regurgitation, and so to disturb the compensation of the left ventricle even if this had previously become adjusted. Additional cardiac hypertrophy is greatly interfered with by the condition of the blood, and by interference with the action of the heart owing to increasing abdominal pressure on the diaphragm. As a rule, dyspnœa, restlessness, want of sleep, and œdema soon manifest themselves, and premature labour results. Whether the last occurs, or whether the case goes to full term, it is hardly necessary to point out that the greatly increased strain of 'bearing down' may be the 'last straw' to the overtaxed ventricle—a condition of asystole is very prone to occur, and cause the sudden death of the patient.

The second stage, therefore, is again the chief period of anxiety. Bearing-down efforts, associated with a great increase in the blood pressure, bring about greater regurgitation into the ventricle, and call for increased lifting power on the part of the ventricle, and these throw such an enormous strain upon the latter that it becomes unable to empty itself. Hence it is that syncope is of frequent occurrence, may repeatedly recur, and may prove fatal, and hence, also, we can explain the beneficial effects of delivery and the return to a normal blood-pressure.

Of the different forms of cardiac lesion, aortic regurgitation is the one in which the greatest benefit might be expected from the induction of premature labour. To be of benefit, however, it must be undertaken as soon as any symptoms of distress appear, otherwise the symptoms will progress in urgency and usually bring on labour, which then, however, gives little relief. Even if symptoms are absent throughout the pregnancy, they almost certainly appear when labour sets in. Delivery should therefore be accomplished as rapidly as possible, the os being dilated artificially, and bearing-down efforts being lessened as much as possible.

Mitral Regurgitation. — Mitral regurgitation is the most common cardiac affection, and perhaps presents the greatest differences in degree. The fact that the lesser degrees of regurgitation and the well-compensated cases preponderate, gives to this condition its less serious position relative to the other cardiac lesions. On the other hand, when regurgitation is extreme and when tricuspid regurgitation is added, the case is well-nigh hopeless. This is the condition which almost inevitably supervenes when successive pregnancies occur in a woman with an already damaged mitral valve, and which makes the prognosis in all cases so grave for the married woman who suffers from mitral regurgitation.

Mitral regurgitation appears to be a less grave complication of pregnancy than is stenosis, partly because as a rule these patients are more robust than are those with stenosis, and so make a better fight. Premature labour also is not so liable to occur in mitral regurgitation, and a much larger proportion of cases go through two or more pregnancies. Here-in, however, lies one great danger. With a damaged mitral valve, it is quite difficult enough for the heart under ordinary circumstances to keep up sufficient compensation. The disturbances of pregnancy disorganise that compensation, and each succeeding pregnancy makes matters worse. Each pregnancy, therefore, is attended with more marked cardiac symptoms and with greater danger than was the previous one, until eventually the limit of the power of compensation of the heart is passed.

In this condition, the hypertrophy of the left ventricle, which occurs with pregnancy, acts disadvantageously in the case of a leaking valve, as the hypertrophied ventricle throws the blood with greater force back on the already dilated auricle, and so increases the engorgement of the lungs. Hence, œdema and pulmonary symptoms with hæmoptysis are common. This hypertrophied condition of the left ventricle affords an explanation why there is not a greater relief of symptoms after delivery. The termination of pregnancy has no immediate effect on the size and strength of the ventricle, which goes on pumping back its blood through the leaking valve and keeping up the distension of the auricle and the engorgement of the lungs and right heart. Thus it is that, though labour has been safely and perhaps easily accomplished, the cardiac symptoms continue and delay convalescence, or, it may be, the symptoms increase in severity, and after weeks or even months cause a fatal termination.

During labour, the serious nature of the case is shown by irregularity and failing power of pulse, restless dyspnœa, and cyanosis. When any of these appear, the second stage must be carried through quickly, and with little strain to the patient. Ether should be used for producing anæsthesia. Under the anæsthetic bearing-down efforts are stopped, and, the muscles being relaxed, the vessels dilate, circulation goes on more freely, and the blood-pressure falls, thus relieving the heart. If necessary, the os should be dilated artificially, and the stage completed as rapidly as possible by the forceps. Free hæmorrhage during the third stage appears to be of real benefit, by relieving congestion and preventing engorgement of the already overloaded right side of the heart.

The after-treatment of the case should be similar to that which has been suggested in cases of mitral stenosis.

Combined Aortic and Mitral Lesions.—No attempt will be made to discuss mixed cases of aortic and mitral lesions. It may, however, be said that it is peculiar how often the rare condition of aortic regurgitation is associated with mitral narrowing. The combination is a serious one, as the addition of mitral narrowing makes the consequences of the aortic regurgitation more serious.

In mitral narrowing and regurgitation, the symptoms of stenosis generally predominate. The prognosis is naturally more serious than when either condition exists alone.

HYPEREMESIS GRAVIDARUM

Hyperemesis gravidarum is the term applied to the uncontrollable vomiting which occasionally attacks pregnant women. As will be seen when its ætiology is discussed, it is perhaps more correctly regarded as a symptom of various pathological conditions than as a pathological entity.

Frequency.—Hyperemesis is fortunately a condition which is but seldom met with. According to Pick, its frequency is about one in a thousand. At the Rotunda Hospital, it occurred 15 times amongst 20,000 labours.

Ætiology.—Hyperemesis occurs in conjunction with a number of very different pathological conditions. It is found as the result of different gastric and intestinal diseases, in association with lesions of the generative tract, as apparently a pure neurosis, and in conjunction with other symptoms which all point to the presence of a profound auto-intoxication. The principal gastric and intestinal disturbances which may give rise to uncontrollable vomiting are gastric ulcer, inflammatory conditions of the stomach or intestinal wall, and more rarely partial or complete obstruction either occurring in consequence of the uterine enlargement or as an accidental concomitant of pregnancy. Lesions of the generative tract have, in the past, been frequently put down as the cause of hyperemesis, particularly uterine displacements, cervical lacerations and erosions, and endometritis, and such conditions may be a cause of reflex irritation sufficient to produce gastric disturbances. We doubt, however, that they ever cause vomiting so severe as to be properly called hyperemesis. A pure neurosis, in the form of hysteria, may sometimes be sufficient to cause vomiting, even to such an extent that the condition of the patient becomes critical. Williams relates a case in which the patient, who had vomited incessantly for several weeks, was immediately cured when he drew a vivid picture of the dangers of inducing abortion, and informed her that such a course would be necessary. The most important cause of uncontrollable vomiting is, perhaps, however, the auto-intoxication which sometimes occurs during pregnancy in the case of patients who neglect the ordinary hygienic precautions of pregnancy, and in whom there is a failure of the eliminatory functions of the body. Such cases commence with morning sickness and constipation, and are usually associated with renal disease and partial suppression of urine. The ætiology of hyperemesis is closely allied with that of eclampsia. Both conditions are found as the result of reflex irritation of the higher centres, and of auto-intoxication, and both conditions are most frequently found in association with renal disease. The resemblance has been still more emphasised by the fact that several observers* have reported cases of hyperemesis in which the *post-mortem* examination showed the presence of lesions of the kidney, liver, and other organs identical with those observed in eclampsia.

Symptoms.—The essential symptom is the occurrence of severe vomiting occurring at all hours of the day, and brought on by any slight stimulus—such as a sudden movement, a loud noise, a bright light, or by the taking of food. The vomited matter consists of the ordinary contents of the stomach, with the addition of acid mucus, and of slight traces of blood, the result of straining. In serious cases, the patient is usually completely constipated, and the amount of urine passed is very small. The breath is most offensive. The skin is dry, and perhaps slightly jaundiced. The lips and mouth are also dry, and sordes accumulate about the teeth. The patient becomes more and more debilitated and emaciated. Her pulse is small, frequent, and finally irregular, and her temperature, which in the early stages of the condition may be subnormal, rises as the condition becomes worse to 103°-104° F.

Treatment.—The prophylactic treatment of hyperemesis is of considerable importance, especially in cases in which the ordinary morning sickness of pregnancy shows any sign of being unduly violent or prolonged. It consists in the adoption of the usual measures for allaying morning sickness, in the regulation of the bowels, and in the removal of any source of reflex irritation from the genital tract. In addition, the urine should be examined with a view to the early detection of any form of renal disease.

The curative treatment of hyperemesis consists first of all in efforts to ascertain the exact cause of the sickness. Clinically, two classes of case are met with:—first, cases of a comparatively mild type, which get well when their cause is removed; and, secondly, cases of a more severe type, dependent on functional or organic disease. The treatment of the former class is directed to the removal or cure of any sources of reflex irritation, such as uterine displacements, cervical inflammations, etc., the regulation of the bowels, and the administration of any of the usual anti-emetic drugs. In cases due to hysteria or other neurotic condition, suggestion is sometimes of use, as in the case recorded by Williams. If it fails, the administration of sedatives in fairly large doses, such as chloral hydrate or bromide of potassium will often bring about the necessary depressant effect on the nervous system and will check the vomiting. They will in most cases have to be given by the rectum, as if given by the mouth they will be immediately rejected. The treatment of the more severe cases due to profound auto-intoxication is a far more difficult matter. The general lines of treatment are practically identical with those recommended for a similar condition occurring in connection with eclampsia. The bowels must be evacuated by purgatives and injections. The action of the kidneys, if deficient, must be stimulated, and also the action of the skin. Hot baths, if the patient's condition permits them, wet packs, and vapour baths are indicated. If possible, the patient must be got to retain fluids given by the mouth, and saline infusions into a vein or into the cellular tissue may prove of use. All sources of reflex irritation must be removed, and with this object the patient must be kept in a quiet and darkened room. If, as is usually the case, nourishment cannot be given by the mouth, rectal feeding must be resorted to. If these measures fail, as a last resource, abortion or premature labour as the case may be, must be induced, and, if benefit is to be obtained, the procedure must not be postponed too long. There is a natural tendency to avoid such extreme measures as long as possible, and the most difficult point in the management of the case is the recognition of the moment at which they can no longer be postponed. It is impossible to lay down a rule to govern the time at which their adoption is necessary, but, speaking generally, as soon as the patient's condition is such as to give rise to anxiety, and is becoming daily worse, in spite of the adoption of the treatment which we have outlined, labour should be induced. If it is to be induced at all, it must be before her condition becomes so critical that there is little or no hope of benefit resulting.

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* Bouffe de Saint-Blaise, 'Les Auto-intoxications gravidiques,' *Annales d. Gyn. et d'Obstét.*, 1898, vol. i., pp. 342-374, and 432-455; and Dirmoser, 'Der vomitus gravidarum perniciosus,' Wien, 1901; Pick, 'Ueber Hyperemesis grav.,' *Volkmann's Sammlung Klin. Vorträge*, N.F., 1902, Nos. 325, 326.

Prognosis.—Mild cases of hyperemesis due to a removable reflex cause are, as we have said, usually cured by the removal of the cause, and consequently the prognosis is distinctly good. The prognosis of the other class of cases is however, extremely bad, inasmuch as, as a rule, the patients are rarely seen in time to restore the action of the eliminatory organs. In hospital practice, especially, patients suffering from hyperemesis rarely come under treatment until they are so far gone that they are unable to stand even the manipulations necessary for the induction of labour.

ECLAMPSIA

Eclampsia is the term applied to epileptiform attacks occurring in pregnant or puerperal women, which are the manifestations of a cerebral intoxication or over-activity arising as an indirect result of the pregnancy. By thus defining eclampsia, we wish to make it clear that it is not a term to be applied to one particular form of convulsive attack which occurs during pregnancy, but is rather to be applied to any form of convulsive attack which may occur from any cause, provided that cause is primarily due to the effects of pregnancy on the organism of the patient.

Frequency.—The frequency of eclampsia is a rather difficult matter to ascertain. If the statistics of lying-in hospitals are followed, the percentage which is thus obtained will be too high, as there will always be found in hospitals a relatively greater number of primiparæ than of multiparæ, and also as a patient is more likely to seek the aid of a hospital if she feels herself seriously ill, than if she is expecting her confinement in her ordinary health. The statistics of various British and Continental hospitals and clinics give the following figures:—Amongst 227,000 patients there were 635 cases of convulsions—*i.e.*, a proportion of .1 case in 357·48. All these cases may not have been eclampsia, but the proportion almost exactly corresponds to that at the Rotunda Hospital, where amongst 20,000 patients there were 56 cases of eclampsia, a proportion of 1 in 357·14.

Pathological Anatomy.—At the autopsies of patients who have died of eclampsia, a tolerably uniform series of pathological conditions are met with in the various organs. The organ most constantly affected, and the one whose condition is most closely connected clinically with the symptoms of the case, is the kidney. The next most constantly affected organ is the liver, and after it the brain. There is, however, no one lesion which has come to be definitely regarded in the light of a primary lesion. If the various organs are examined one by one, the following changes are found:—

The Kidneys.—In from 90 to 95 per cent. of cases the kidneys are affected, most commonly by the condition known as pregnancy kidney. According to Leyden,* this is not a true nephritis, but rather the result of simple anæmia, and is characterised by a fatty infiltration of the renal epithelium, especially of the convoluted tubes. The cause of this anæmia is attributed by Dührssen, Spiegelberg, and others, to spasm of the renal arteries, due to their reflex irritation by stimuli from the genital tract. Such stimuli are furnished by the contractions or great distension of the pregnant uterus, by the entrance of the head into the pelvis, and by the onset of labour. Volhard attributes renal anæmia to the blocking of the nutrient vessels by emboli caused by the action of some coagulation-producing ferment upon the blood. Much more rarely the lesions of true chronic nephritis are found associated with eclampsia, and in a very small proportion of cases the renal changes can be attributed to the effects

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* 'Einige Beobacktungen über Nierenaffectionen,' etc., *Zeits. f. Klin. Med.*, 1881, ii. 171-191.

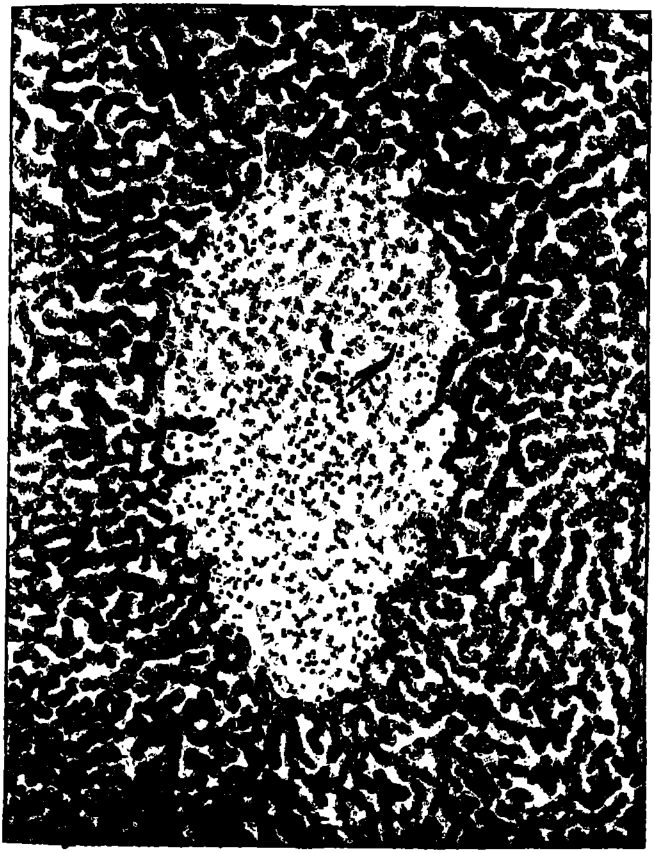

FIG. 285.—AREA OF NECROSIS IN ECLAMPTIC LIVER. × 90. (Williams.)

of obstructive suppression of the urine, due to pressure on the ureters (Halbertsma*).

The same areas of necrosis as are found in the liver are also to be sometimes found in the kidneys, and can be attributed to like causes.

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* 'Ueber die Ætiologie der eklampsia puerperalis,' *Volkmann's Sammlung Klinische Vorträge*, 1884, No. 212.

The Liver.—Ecchymoses are frequently scattered over the surface of the liver. Some of these are the size of a pin's head, while others may be half the size of the palm of the hand. On section, the colour of the liver substance is more yellow than usual, owing to varying lesions of the epithelium (Pilliet*). Hæmorrhages, resembling the sub-capsular hæmorrhages, are found scattered round the portal interspaces, and under the microscope are seen in three different stages. In the first stage, they consist of a circular area of dilated intralobular capillaries, situated close to a portal space, and about the size of a grape-stone. In the second stage, these areas of engorgement have increased in size. Round their periphery there is a ring of dilated capillaries, while the centre has become necrotic, and consists of a mass of dead liver cells, blood corpuscles, vessels, and fibrin. In the third stage, the areas have still further increased, and in places where they were near one another have coalesced. In this way, islands of necrosis are formed surrounded by a small-celled exudation, and from them emboli of liver cells (Jurgens†) or of fat (Virchow) may be carried to other organs.

There is a wide difference of opinion with regard to the origin of the hæmorrhages which produce these necrotic areas, as we shall see in discussing the various theories of eclampsia. Here, it is sufficient to say that they may occur in one of several ways:—First, as the result of the bringing to the liver, in the blood, of some toxic substance—chemical or bacterial in origin—which destroys the liver cells; secondly, as the result of embolic infarction of the liver, the emboli coming from the placenta, and being formed of fœtal ectoblast—*i.e.*, of the syncytium and Langhans' layer—or being formed by the action of some coagulation-producing ferment on the blood; and, thirdly, as the result of the rupture of small bloodvessels during an eclamptic fit. Similar areas are found in the spleen, kidney, pancreas, brain, and lungs.

The Brain.—The brain is sometimes hyperæmic, sometimes anæmic. There is often marked œdema, leading to consequent flattening of the convolutions, and minute hæmorrhages may occur in various parts. These changes are in all probability the result of increased blood-pressure during a convulsion.

The Spleen.—The spleen is enlarged, congested, and diffluent. Sub-capsular hæmorrhages and similar areas of necrosis as are found in the liver are sometimes present.

The Pancreas.—The pancreas also presents areas of necrosis, and may be markedly anæmic.

The Lungs—The lungs are congested, especially at their bases.

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* 'Lésions du foie dans l'eclampsie avec ictère,' *Nouv. Arch. d'Obstét. et de Gyn.*, 1889, iv. 312-367.

† 'Fettemboli und Metastase von Leberzellen bei Eklampsie,' etc., *Berliner Klin. Wochenschr.*, 1886, 519

There are also sub-pleural ecchymoses, and emboli with necrotic areas are found, as in other organs.

The Fœtus and Placenta.—Somewhat similar conditions have been found in the liver and kidneys of the fœtus, as are described as occurring in the mother. The placenta is frequently the subject of white infarction, a condition probably due to the accompanying renal disease. It has been suggested that from these areas particles formed of detached portions of syncytium and Langhans' layer may pass into the maternal blood and cause coagulation, as well as acting as emboli.

Ætiology.—Before referring to the numerous theories which have been brought forward—for the most part in a vain effort to establish eclampsia as a specific disease, it is well to enumerate the facts that are known regarding its occurrence. We know that there are certain conditions which predispose to the occurrence of eclampsia. These are as follows:—

(1) Acute and Chronic Diseases of the Kidney.—The association of albuminuria with eclampsia is perhaps the oldest fact known regarding the pathology of this condition. Until comparatively recently, it was believed that eclampsia could not occur apart from albuminuria, and although this assumption has been disproved, the association of the two is very constant. Out of 195 cases of eclampsia recorded by Duhrssen in which the urine was examined, albumen was present in 189 cases, or 96 per cent.; considerable quantities of albumen in 174 cases, or 92 per cent.; casts, epithelium, etc., in 121 cases, or 65 per cent.; hæmoglobinuria in 4 cases, or 2 per cent.; and urobilin in one case. Further, there was œdema of the tissues in 113 cases, and 'other evidence of kidney disturbance' in 25 cases. The nature of the alterations in the kidney substance have been already referred to. They are so very various that it is probably correct to assume that any form of renal disease may be found in association with eclampsia.

(2) Long Retention of the Excretions.—Prolonged constipation and failure in the action of the skin and kidneys are, as a rule, associated with eclampsia, as are any other factors that tend to cause the excessive formation of toxins in, or the non-excretion of toxins from, the body. In this category may be included failure in the hepatic function, and possible diminution in the secretion of the thyroid gland.

(3) Primiparity, especially in Unduly Young or Unduly Old Women.—According to the aggregated statistics of a number of well-known obstetricians, eighty per cent. of patients suffering from eclampsia are primiparæ. In the 195 cases recorded by Duhrssen, 40·5 per cent. were either below twenty or over thirty.

(4) A neurotic temperament, especially if hereditary.

(5) Excessive size of the uterus, as in hydramnios and multiple pregnancy.

(6) Obstructed delivery.

The number of theories which have been advanced to account for the occurrence of eclampsia is sufficient evidence of the uncertainty with which the pathology of the disease is surrounded. The most important of these theories are the following:—

Frerichs' Theory.—Frerichs' theory, that eclampsia is due to the presence in the blood of urea, or of carbonate of ammonium formed from urea under the influence of some fermentative process, is untenable for several reasons. There has not been found any storage of urea in the liver or muscles in the case of patients who have died of eclampsia; nor, in the case of those who recover, is there any increased quantity excreted. Furthermore, urea has been injected into the blood without causing convulsions. Bouchard even attributes a diuretic effect to it, and under his advice Pinard employed it, as a hypodermic injection, in 1887, in the case of anuric eclamptics. The carbonate of ammonium theory has been overthrown by Bernard, who demonstrated the fact that it was present in the same proportion in the blood of a healthy man as in that of an eclamptic.

The Bacterial Theory.—The bacterial theory of eclampsia has never made much advance, although it has from time to time had strong supporters. Herrgott[*] attributes some cases to such a cause, while Stroganoff[†] strongly upholds the view that eclampsia is a contagious disease.

The objections to a bacterial theory are that eclampsia is never an epidemic disease; that it is more common amongst primiparæ than amongst multiparæ; and that no bacterium constant in its presence or capable of reproducing the disease has been isolated.

The Neurotic Theory.—The neurotic theory attributes eclampsia to a heightened irritability of the nerve-centres, or to excessively strong stimuli from the uterus (eclampsia reflectorica). This theory receives support from cases which show the influence of heredity or of a neurotic disposition, and helps to explain those cases in which no evidence of renal disease can be found. Ribemont-Dessaignes and Guéniot bring it to the assistance of the renal auto-intoxication theory, as furnishing the necessary predisposing factor, by the concurrence of which, poisoning by urinary extractives can cause the onset of eclamptic attacks.

Stumpf's Theory.—Stumpf's theory,[‡] that the fits are due to the circulation in the blood of some poison produced by an abnormal decomposition in either mother or child, has received a certain amount of revived support of late. Stumpf considered that, 'under abnormal processes of decomposition, a substance free from nitrogen, toxic in its action, perhaps acetone, or a body resembling it which reacts to the same tests, may be formed. That this body produces by its excretion an irritation of the kidneys which may eventually lead to nephritis, has a destructive effect upon the colouring matter of the blood, greatly alters the activity of the liver cells, causes sugar to appear in the urine, and produces the destruction of the parenchyma of the liver leading to acute yellow atrophy of the organ with the formation of tyrosin and leucin, and induces coma and convulsions from an irritation of the brain.' Fehling[*] has lent support to this theory. According to him, it may be that the metabolism of the fœtus and the transference of the final products into the maternal circulation are of more importance than has hitherto been supposed. The nephritis of pregnancy is, he thinks, most probably not the cause of eclampsia, but the first sign of intoxication, of which eclampsia, if it supervenes, may be the second. The fact that the fœtus almost always dies in these cases, the predisposition to eclampsia in the case of multiple pregnancy, and the improvement in the prognosis for the mother which the death of the fœtus affords, are all in favour of the supposition of the cause of eclampsia being produced in the fœtus. Schmorl[†] ascribes eclampsia to an intoxication by coagulation-producing ferments which originate in the placenta, and which cause thrombi in the various organs. As we have already pointed out, these thrombi are probably due to syncytial emboli, and possess no pathological importance.

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[*] *Annales de Gyn.*, 1893, xxxix., 1-8, 109-120.

[†] *Centralb. f. Gyn.*, 1901, 1309-1312.

[‡] *Trans. First German Gynæcolog. Congress in Munich*, Leipzig, 1886, pp. 191-173; and *Münchener Med. Wochen.*, 1887, Nos. 35 and 36, pp. 671-674 and 693-695.

The Urinæmic Theory.—This theory, which has received considerable support,[‡] attributes the onset of fits to the retention of the normal urinary toxins owing to the failure of function on the part of the kidney, and so makes them the symptom of urinæmia. To such a poisoning, all the constituents of the urine would contribute. Coincidently with the onset of the premonitory symptoms of eclampsia, the urine has been found to diminish in toxicity. It also diminishes in amount, so that there must be a consequent retention of the normal urinary toxins in the body. Coincidently with the recovery of the patient, the toxicity of the urine increases, as also does the total amount of urine passed. The fact that eclampsia so frequently occurs in patients suffering from renal disease, and that it rarely or never occurs when this condition has been so treated that urinary suppression does not occur, are strong points in favour of this theory; while, on the other hand, the latter furnishes no explanation of the morbid appearances which are met with in the liver; nor does it account for those cases—about five per cent. of the entire number—in which there is no evidence of renal disease. Recent investigations[§] go

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[*] *Volkmann's Sammlung Klin. Vorträge*, N.F., 1899, No. 248, and *Verh. der Deutschen Gesel. f. Gyn.*, 1901, 239-261.

[†] 'Path. Anat. Untersuchungen über Puerperal-eklampsie,' Leipzig, 1893, and *Archiv f. Gyn.*, 1902, lxv., 504-529.

[‡] Bouchard, Peter, Schöttin, and others.

[§] Forchheimer and Stewart, 'On the Toxicity of the Urine,' *Amer. Journ. of Med. Sciences*, September, 1899, pp. 297-303; and Schumacher, 'Exper. Beiträge zur Eklampsie-frage,' Hegar's *Beiträge zur Geb. und Gyn.*, 1901, v. 257-309.

to show that the toxicity of eclamptic urine has been over-estimated, and that the bad effects that followed its injection into animals were really due to its contamination by micro-organisms.

Bouchard's Theory.—Bouchard's theory*—the so-called auto-intoxication theory—though that term will also apply to the last—attributes eclampsia, not only to a failure of function of the kidneys, but also of the liver. As a result of this failure, intoxication occurs, not only from urinary extractives, but also from biliary substances which remain in the blood, and from toxins which are no longer destroyed in the liver. Auvard and Riviere† add to this theory the effects of the failure of elimination in the skin and lungs, while Bouffe de Saint-Blaise‡ considers the hæmorrhagic infarcts of the liver as the pathognomonic lesion of eclampsia, to which even the convulsions themselves are of secondary importance. The cause of this lesion, he thinks, may be found in some chemical or septic toxin which is formed in the intestine, and is brought to the liver by the blood. There can be no doubt that hepatic as well as renal incompetence plays a certain part in the pathology of eclampsia, but whether this incompetence is primary or secondary is extremely doubtful.

Perhaps the most recent theory that has been brought forward is that of Nicholson, who attributes eclampsia primarily to defective action of the thyroid gland, whereby the normal amount of thyroid juice is not set free. The action of iodothyrin—the active principle of the thyroid juice—has been shown to be the opposite of that of the internal secretion of the supra-renal glands, and that whereas the latter tends to raise the blood-pressure and to contract the arterioles, the former tends to lower the blood-pressure and to dilate the arterioles. Nicholson considers that these secretions normally counter-balance one another, and that it is probable that if the iodothyrin is diminished, the secretion of the supra-renal glands produces an intense constriction of the renal arterioles, and so diminishes the secretion of urine; further, that proteids which should have been modified by the action of iodothyrin, come to the liver unchanged, and so throw extra work on that organ. Thus a failure of elimination and an accumulation of toxins result, and lead up to the onset of eclamptic convulsions.

So far as we can see at present, it appears manifest that auto-intoxication has much to do with the onset of eclampsia. How exactly the intoxication arises cannot be definitely laid down, but it is more than probable that it may occur in one or more of several different ways. Failure in one eliminatory organ will lead so quickly in turn to failure in another, that it is difficult to ascertain which organ was the first to fail, and it is equally impossible to say with accuracy whether the presence of toxic substances in the organism is the cause or the result of the eliminatory failure. For this reason, it seems to us to be an easy matter to multiply apparent primary causes of the onset of eclamptic fits, but to be impossible to establish anything in the nature of a constant primary cause. This is but another way of saying that there is no such thing as a specific disease eclampsia, but that eclamptic fits are the symptom of many pathological conditions found in association with pregnancy, the most important, perhaps, of which is auto-intoxication in some form.

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* Leçons sur l'Auto-intoxication, Paris, 1887.

† 'Pathogénie et Traitement de l'Éclampsie,' Paris, 1889.

‡ *Annales de Gyn. et d'Obst.*, 1891, xxxv. 48; 1898, l. 342-373; 1900, liv., 76, 77.

It, therefore, seems most rational in the present state of our knowledge to consider eclampsia, not as a specific disease the result of one definite condition, be it of the liver, or of the kidney, or of the higher centres, but rather as a symptomatic condition, the result of direct over-stimulation of the nerve-centres by toxic substances circulating in the blood, or of their reflex over-stimulation by peripheral irritation from the genital tract. In each patient, the nature of the toxin or of the peripheral irritant may differ, and with it the special symptoms of the case, but, in each, the pathognomonic symptom will be the occurrence of convulsive attacks. Looking at the origin of eclampsia in this light, we find that its causes can be classified in general terms in the following manner:—

I. The direct stimulation of the nerve-centres by toxic substances circulating in the blood owing to—

  (1) The accumulation of normal toxins in the blood from failure of the renal, hepatic, or intestinal eliminatory functions, due to pre-existing disease of these organs.

  (2) The excessive formation of normal toxins, or the formation of abnormal toxins, either in the mother or the fœtus, which in their process of excretion through the kidneys cause nephritis, and so a diminished renal function, and so a further increased amount of toxins in the blood.

II. The reflex stimulation of the nerve-centres, due to—

  (1) Their over-excitability to normal stimuli, as in the case of hysterical patients or epileptics.

  (2) Their over-irritation by excessive stimuli, as in the case of obstructed labour, very painful labour pains, very old or very young primiparæ.

Time of Onset.—An eclamptic fit rarely occurs prior to the sixth month, or after the fifth day of the puerperium, and within these limits it may occur at any time either during pregnancy, labour, or the puerperium. The following list shows the date at which one hundred cases collected by Tarnier and by Bar occurred:—During the fifth month, 1 case; sixth month, 8 cases; seventh month, 15 cases; eighth month, 33 cases; eighth and a half month, 36 cases; and ninth month, 7 cases.

The relative frequency with which the fits commence during pregnancy, labour, or the puerperium, as shown by the aggregation of various Continental and American statistics,* is as follows:—During pregnancy, 36·12 per cent.; during labour, 48·48 per cent.; and during the puerperium, 15·4 per cent. It is, however, probable that many cases, which actually started during pregnancy, have been counted as starting during labour, owing to uterine contractions having commenced at the time the case first came under observation, and that in reality the greater number of cases commence during pregnancy.

Symptoms.—The symptoms of eclampsia must be considered two under heads prodromal symptoms, actual symptoms.

Prodromal Symptoms.—The first prodromal symptom of eclampsia may be said to show itself the moment a pregnant woman passes urine containing albumin, if previously her urine was healthy. In this connection, the following rule may be given:—It is *advisable* to examine the urine of every pregnant woman during the sixth and seventh month, and to ascertain the amount passed in twenty-four hours. It is *necessary* to do so if from her history or appearance we have any grounds for supposing that she may be suffering from albuminuria. The remaining prodromal symptoms of eclampsia occur a short time before the onset of the fits, and their early recognition is a matter of necessity, as by so doing it is possible in many cases to completely ward off the threatened attack. They consist in complete or partial, temporary or permanent, loss of vision, flashes of light before the eyes, vertigo, headache, drowsiness, mental depression, nausea, constipation, and epigastric pain. Coincidently with the foregoing, the amount of urine passed is, as a rule, markedly diminished, and the amount of albumin in it increased.

Actual Symptoms.—The actual symptoms commence with the onset of the fits. A fit lasts from one to one and a half minutes, and consists of three stages—a preliminary stage, a tonic stage, and a clonic stage, followed by a varying period of coma.

The preliminary stage lasts from a half to one minute. It consists of various convulsive movements of the head and facial muscles. The eyelids twitch vigorously, the eyeballs are deviated to one or other side and upwards, the nostrils quiver, and spasms of the muscles of respiration occur. The tonic stage then commences and lasts from fifteen to twenty seconds. The patient becomes rigid, the head thrown backwards and to one or other side, and the trunk in a position of opisthotonos. Respiration is arrested, the jaws are tightly clenched, and the tongue, which was protruded in the preliminary stage, may be violently bitten. The clonic stage follows, and lasts a varying period, the tonic spasms passing off gradually, and being replaced by sharp rhythmical movements—the patient 'works.' Finally, the clonic movements cease, respiration returns, and the patient lies in a condition of deep coma. The duration of the coma varies according to the number of fits which the patient has had. At first, it only lasts for a few minutes, but, as the number of fits increase, it lasts in the intervals between them. The number of fits vary greatly. The patient may only have one, while on the other hand as many as a hundred have occurred. They may pass off entirely for a time, and then recur. In a severe case, they follow one another at ever-shortening intervals. In such a case, the heart's action soon becomes affected, and is frequent, weak, and finally intermittent. The lungs are also involved, and become congested, partly as a result of the failure of the heart, and partly from the irritation caused by the entrance of particles of food and mucus—'deglutition pneumonia.' The temperature, which at first was normal, gradually rises as the fits recur, and may finally reach a height of 104° F. Total or partial loss of vision is also of frequent occurrence. There is almost complete suppression of urine and constipation.

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* Olshausen, Pinard, Knapp, Goldberg.

Diagnosis.—The foregoing description of an eclamptic attack is the description of a typical case, and it must be borne in mind that the greatest divergence from this type may be met with, and that the attack may assume the most atypical form. For this reason, too much reliance must not be placed on the form of the convulsion in making a diagnosis of the nature of the case. More information will be obtained by studying the prodromata, the history, and the attendant symptoms.

Eclampsia must be distinguished from epilepsy, hysteria, drunken delirium and coma, and the coma and convulsions of meningeal and cerebral disease. As a general rule, it may be stated that every form of convulsion in a pregnant woman who is suffering from renal disease should be regarded as eclamptic in origin until the reverse is proved. Epilepsy may be recognised by the history of former attacks, by the absence of the usual eclamptic prodromata, by the initial epileptic aura, by the sharp onset of the convulsive seizure, and by the usually complete absence of all renal symptoms. Hysteria is recognised by the extreme irregularity of the convulsion, by the absence of respiratory spasm, of all actions which would hurt the patient, and of loss of consciousness, and by the passage of large quantities of pale urine. Alcoholic coma and delirium may be suspected from the history of the case, and the spirituous odour of the breath. It can be definitely recognised, as it gradually passes off, and does not recur. The urine also is probably free from albumin. The coma and convulsions of meningeal and cerebral disease may be indistinguishable from those of eclampsia if the history of the onset of the case cannot be obtained. It must not be forgotten that the two conditions may coexist, as cerebral hæmorrhage occasionally occurs in the course of eclampsia.

Complications.—The principal complications of eclampsia, if indeed they can be considered as such, and not rather as integral parts of the disease, are failure of the heart and consequent œdema of the lungs. Cerebral hæmorrhage may occur from the rupture of a vessel during a fit, or even after the fits have ceased. Septic pneumonia may result from the inspiration of foreign bodies into the lungs.

Treatment.—The treatment of eclampsia must be considered under two heads—prophylactic treatment and curative treatment.

PROPHYLACTIC TREATMENT.—Prophylactic treatment must be adopted in the case of every pregnant woman who has persistent albuminuria, especially if the urine also contains tube-casts. Such treatment must be carried out still more rigorously if any of the other prodromata of eclampsia appear. The importance attributed to prophylaxis will be shown by the following opinions:—'When a patient suffering from albuminuria has been on milk diet for a week, she almost to a certainty escapes eclampsia' (Tarnier). 'Eclampsia occurs almost exclusively in women whose urine has not been examined during pregnancy' (Ribemont-Dessaignes). 'The author has never yet seen a case of eclampsia occur amongst the numerous cases of kidney of pregnancy where this method (*i.e.*, prophylactic treatment) has been adopted during pregnancy' (Dührssen).

It is practically impossible, and it is rarely necessary, to enforce an absolute milk diet from the date at which renal disease is first recognised, *i.e.*, about the sixth month, to the end of pregnancy. It will usually suffice if milk and other fluids are made to take a great share in the dietary. In addition, fish, white meat, eggs, and vegetables may usually be allowed. If milk diet is not essential, the due regulation of the eliminatory functions of the body is. The bowels must be freely moved each day, the skin must be encouraged to act by frequent warm baths, and the amount of urine passed daily must be noted. The dietary of the patient and the daily amount of urine should be in direct proportion to one another, and the freer the action of the kidneys the more liberal may be the dietary. The moment the former show any signs of failure, the latter must be reduced to milk alone, to be cautiously made again more varied as the renal action improves.

If the urine diminishes to a marked extent, and any of the prodromal symptoms of eclampsia appear, a hydragogue purgative must be at once administered. At the same time, to increase the action of the skin, hot baths and wet packs must be ordered, and the patient kept wrapped in blankets. A suitable purgative to administer in these cases consists of ten grains of Calomel, combined with a drachm of Pulv. Jalapæ Co., and followed, if necessary—as is sometimes the case, by an enema at the end of six hours.

CURATIVE TREATMENT.—The curative treatment of eclampsia is directed in the main towards two principal points—the arrest of the fits, and the staving off of complications.

The fits must be checked at the earliest possible moment, as each successive attack leaves the patient more liable to fall a victim to the complications of a failing heart and œdema of the lungs. There are three ways of attaining, or of endeavouring to attain, this end:—By administering sedatives, by removing toxic substances from the blood and tissues, and by emptying the uterus.

By Administering Sedatives.—There are two distinct lines of treatment which fall under this head—the chloral and chloroform treatment, and the morphia treatment.

The chloral and chloroform treatment consists in administering, upon the onset of an attack, thirty grains of chloral hydrate by the rectum, and repeating it every two hours until the fits cease. Up to three and a half drachms may be given within twenty-four hours, but not more. The inhalation of chloroform is commenced as soon as any sign of the onset of a fit is noticed, and is continued until the fit is over. The great objection to this line of treatment is that both chloroform and chloral exert a depressant effect upon the heart, and consequently tend to favour the occurrence of heart failure.

The morphia line of treatment was first introduced by Veit.* It is the treatment which the writer recommends, as he considers it superior to the chloral and chloroform treatment. It consists in the administration of half a grain of morphia hypodermically as soon as a fit occurs. A quarter of a grain is then administered every two hours until the fits cease, but not more than three grains are given in twenty-four hours. Eclamptic patients readily tolerate such large doses. Morphia will check convulsions quite as rapidly as chloroform, as statistics show, while at the same time it has not the same depressant effect upon the heart. It in addition relaxes the bloodvessels, and so lowers the blood-pressure, and temporarily arrests the metabolic processes of the body.

By Removing Toxic Substances from the Blood and Tissues.—The rapid removal of toxic substances from the organism of the patient is a matter of the greatest importance, inasmuch as it is apparent that even if these substances are not the actual cause of the convulsions, they are always present in large quantities, and their removal is attended by almost immediate improvement. Their removal is effected in the main by promoting the excretory functions of the body, and with this object cathartic purgatives are administered. The calomel and jalap powder, as recommended above, if the patient is conscious, is the best purgative. If, however, she is comatose, it is useless to place bulky medicine in her mouth, as it would not be swallowed. In such a case two minims of croton oil made into a bolus with a little butter, and placed as far back upon the tongue as possible, may reach the stomach. A soap and water, or castor oil and turpentine, enema should also be given if necessary. At the same time, the action of the skin must be encouraged, and with this end in view, the patient is kept in blankets, and hot baths administered if possible. If the latter are not possible, a wet-pack or hot-air bath may be tried instead. The amount of urine excreted may be increased by applying hot stupes over the kidneys, while abundance of fluid by the mouth —if the patient is conscious—will also be of use. Diuresis, or, at any rate, the dilution of the poison, can also be obtained by intravenous or subcutaneous injections of saline solution.

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* 'Ueber die Behandlung der Eklampsie,' *Ruge's Festschrift*, 1896, 101-120.

Jardine,* of Glasgow, is largely responsible for the introduction of saline infusions in eclampsia. He adopts the practice as a routine in all cases, and has no hesitation in saying that it has given him much better results than any other method. He uses a solution of thirty grains of acetate of soda to the pint of water, and injects up to three pints, according to the nature of the case, into the cellular tissue, preferably beneath the breast. The injection is repeated if it is thought necessary. It may be mentioned that Jardine condemns the use of morphia, on the grounds that it diminishes the amount of urine excreted, and that death from poisoning has followed its use.

In conjunction with saline injections, venesection, to the amount of seventeen ounces, has been recommended, with the object of removing some of the toxin-laden blood, which is then replaced by the saline fluid. Whatever may be the value of venesection in attaining this object, it is undoubtedly of use in those cases in which there is marked engorgement of the right heart and pulmonary circulation (Fehling).

Nicholson, in accordance with his view that eclampsia is largely due to the deficiency of thyroid secretion, recommends the administration of thyroid extract, both as a prophylactic measure and as active treatment. As a prophylactic, he administers the extract in five-grain doses night and morning; while if eclamptic fits have occurred, he considers that the action of the extract given in this manner is not sufficiently active, and consequently recommends the hypodermic injection of ten to fifteen minims of liquor thyroidea repeated every hour or two until signs of improvement result. He, however, considers that morphia should also be used in almost the same manner as that we have already described. If thyroid inadequacy can be shown to exist during the onset of eclamptic fits, then this treatment is a sound one, but there is not as yet sufficient evidence on this point.

By Emptying the Uterus.—If it is determined to empty the uterus before the onset of labour, the os is dilated by Bossi's or Frommer's dilator, or by deep incisions (Dührssen). If the fœtus is dead, its extraction may be facilitated by performing craniotomy; if it is alive, it must be delivered by the forceps or by version and extraction.

The question of the advisability or otherwise of immediately emptying the uterus in all cases of eclampsia has for long been an obstetrical moot-point, on which opinions have been and are likely to be divided. Many obstetricians, who were at the same time expert operators, have obtained good results by adopting this practice. Dührssen in particular, who habitually dilated the uterine orifice by deep incisions and extracted the fœtus, obtained results which enabled him to say that his practice was a certain method of checking the fits.

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* 'Clinical Obstetrics,' 1903, p. 364.

More recently, Bumm* has published results which to a considerable extent support Dührssen's contentions. From 1882 to 1895, he adopted treatment with narcotics in forty-seven cases, using chloroform in twelve, morphia in thirty-one, chloral hydrate with morphia in four. There were fifteen deaths, or a mortality of 30 per cent., and the results were apparently identical in the case of the different narcotics. From 1895 to 1900, he treated forty-three cases by morphia, with the addition of the free use of diaphoretics, and in seven of the worst cases venesection and transfusion. There were thirteen deaths, or a mortality of 30 per cent. From 1901 to 1903, the uterus was emptied at once—*i.e.*, in the case of patients in the clinic after their first or second fit, and in others within at most half an hour of their admission. There were twenty-five cases, including one abdominal and seven vaginal Cæsarean sections, seven forceps deliveries, six cases of podalic version and extraction, one delivery by the presenting foot, and one perforation of a dead child. There were three deaths, a mortality of 12 per cent. The statistics collected by Herman† do not, however, furnish so favourable evidence in support of immediate delivery. They show that the percentage mortality after operative delivery was 25·5, while in the case of those patients who were not delivered by operation it was only 20·8. There is, however, but little doubt that if immediate delivery is to give good results it must be adopted at once, and not as a *dernier ressort*. For this reason, we do not attach the same value to Herman's statistics that we should if they applied to cases of true immediate delivery, and not merely to all cases in which the uterus was emptied. Of late, a considerable stimulus has been given to the practice of immediate delivery by the introduction of Bossi's dilator and its modifications, and the publication of the successful results obtained by its means by Leopold and others. Leopold‡ was able to report twelve cases in which by the use of Bossi's dilator the os uteri was sufficiently dilated in from twenty to thirty minutes to allow the forceps to be applied without laceration, and the fœtus to be delivered without complications. All the patients lived.

At the Rotunda Hospital in the past, narcotic treatment has been almost entirely adopted. From 1889 to 1893, twenty-six patients were treated by the chloral and chloroform method, with seven deaths, or a percentage mortality of twenty-seven. From 1893 to 1903, thirty patients were treated by the morphia method, with seven deaths, or a percentage mortality of twenty-three. The results by both methods are better than those obtained by Bumm, and are slightly in favour of the morphia treatment.

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* *Munchener Med. Wochens.*, 1903, No. 21.

† *Trans. Med. Society of London*, vol. xxv., p. 234.

‡ *Centralb. f. Gyn.*, 1902, May 10.

In the present state of our knowledge, it is as unprofitable to endeavour to dogmatise on the correct treatment of eclampsia as on its true ætiology. The results which are obtained by different lines of treatment are influenced to a great extent by chance—that is to say, by the nature of the particular series of cases the obstetrician happened to meet. When Veit first introduced the morphia treatment he was able to report a series of cases without a death, and similarly when Leopold introduced the use of Bossi's dilator he reported twelve cases without a death. On the other hand, Bumm experienced a mortality of thirty per cent. from the morphia treatment, and doubtless other obstetricians have been equally unfortunate with Bossi's dilator. As we have endeavoured to point out already, eclamptic convulsions are not a specific disease, but a symptom of many pathological conditions. We believe that the most successful results will be obtained by the man who most correctly and most rapidly ascertains the cause of the convulsions in the particular case he is treating, and who varies his treatment to suit the cause.

There can be little doubt that the majority of cases are due to an auto-intoxication, and we have laid down the general principles on which this must be treated. The question as to how the convulsions are to be checked during the removal of the toxins from the system is a much more difficult one. It is too soon to lay down the respective merits of treatment by narcotics or by emptying the uterus. The specialist does not require advice, as he will adopt the method from which he has obtained the best results, until one which furnishes better is clearly demonstrated. The general practitioner, however, must be advised, and we recommend that, if he has not had a considerable experience of operative obstetrics, he should adopt the morphia treatment, and should not empty the uterus until such time as he can do so with the forceps without causing laceration of the cervix. If, however, the morphia treatment proves unavailing, the uterus should be emptied by incision of the cervix and forceps extraction, or by Bossi's or Frömmer's dilator. If, on the other hand, he is an expert operator, the results which have been obtained by Bossi's dilator are such as to justify him in resorting to it, and in delivering the patient as soon as possible after the convulsions have commenced. All such operations must be performed under deep anæsthesia, and care must be taken that the cervix is not lacerated.

The complications associated with eclampsia can to a great extent be avoided by means of intelligent nursing, and by paying the greatest attention to details. While the patient is in a fit, she must not be allowed to bite her tongue or otherwise hurt herself. Biting of the tongue is a common accident. Its occurrence can be prevented by the use of a gag of some form placed between the teeth during the fit. A very serviceable gag can be rapidly made by wrapping a towel or other piece of cloth round the handle-end of a spoon. All feeding by the mouth must be stopped while the patient is unconscious. If it is necessary to administer nourishment while she is in this condition, nutrient enemata must be given. The position of the patient must be such that all fluid which tends to collect in the mouth will trickle out at the side of it, instead of running down into the lungs—*i.e.*, she must lie upon her side, and not upon her back. If the heart becomes weak and rapid, digitalin and strychnine may be administered hypodermically.

Prognosis.—The prognosis for both mother and child in eclampsia is bad, especially for the latter. For the mother, the prognosis varies according to the time at which the fits start. It is worst when they commence during pregnancy or labour; it is best when they commence during the puerperium. The greater the number of fits the worse the prognosis. As a rule, the occurrence of ten fits constitutes a very severe case. If the child dies, the maternal prognosis is improved. The amount of urine passed and the quantity of albumin in it, the presence or absence of marked constipation, the temperature, and the condition of the heart and lungs, are also important guides.

The actual rate of mortality varies very considerably both according to the treatment adopted and according to the nature of particular groups of cases. The following tables give, however, a fair idea of the relative rate of mortality when the convulsions occur during pregnancy, labour, and puerperium; in primiparæ or in multiparæ; and in relation to the number of convulsive attacks:—

Time of Onset.*	Primiparæ.		Multiparæ.	
	Cases.	Deaths.	Cases.	Deaths.
In pregnancy	69	17 (24·3 per cent.)	34	10 (29·4 per cent.)
In labour	115	18 (15·7 per cent.)	31	7 (22·6 per cent.)
After labour	60	7 (11·6 per cent.)	16	4 (25·6 per cent.)

Number of Attacks.†	Cases.	Number of Deaths.	Mortality.
Below 10	152	36	23·6 per cent.
11 to 20	62	17	27·4 „
21 to 30	24	12	50 „
31 to 40	17	13	76 „
41 to 50	5	3	60 „
51 to 60	4	4	100 „

* Lohlein. † Schauta.

CHAPTER VI

THE INTRA-UTERINE DEATH OF THE FŒTUS

Frequency—Ætiology; Pathological Conditions of the Mother; of the Father; of the Ovum; Traumatic Conditions; Unascertained Causes—Symptoms and Diagnosis—Treatment.

It is not proposed to discuss in this book the various intra-uterine fœtal diseases which are met with. They are numerous, and hence it would only be possible to devote a very small and insufficient space to each. Certain of them produce conditions which interfere with the mechanism of delivery, and these will be referred to when treating of the pathology of labour. The remainder, which do not affect pregnancy save in some cases by bringing about the death of the fœtus, and do not affect labour at all, will not be referred to. Their description more properly belongs to a work on ante-natal pathology, and to such we refer the reader.

In the present chapter, we shall deal with the intra-uterine death of the fœtus, its causes, and the treatment necessary to adopt in cases in which its occurrence is not followed by the expulsion of the ovum. It must first be understood that in this chapter we are not dealing with either abortion or premature labour. Either of these conditions may be the result if the intra-uterine death of the fœtus or may be quite independent of such an occurrence. They will be dealt with in another chapter. It is obvious, however, that it is impossible to determine prior to the sixth month whether the death of the embryo or fœtus, as the case may be, is preceded or accompanied by the expulsion of the ovum, save in a few instances, where the embryo has almost or entirely disappeared. This, however, need not affect the general tenor of the present chapter, which will be devoted not to the premature expulsion of the ovum, but to the premature death of the embryo or fœtus, whether that death is followed by expulsion or not.

Frequency.—For the reason just mentioned, it is impossible to tell in what proportion of cases the intra-uterine death of the fœtus occurs prior to the sixth month of pregnancy. In all probability, the proportion of cases in which the death of the fœtus precedes the detachment and expulsion of the ovum is considerable, as in many cases the fœtus has entirely disappeared, or is only represented by a disorganised mass, while, in other cases, it has obviously been dead for some time prior to expulsion.

The proportion of cases in which intra-uterine death occurs subsequent to the twentieth week can be more easily ascertained, but here again errors may occur in consequence of the difficulty of eliminating cases in which death occurred during delivery. It is probable, however, that all, or almost all, premature infants, which are born dead, were dead before labour commenced, as the difficulties of or delay in labour in such cases is but seldom sufficient to cause death. Accordingly, we may include in the number of intra-uterine deaths, all cases in which an immature or premature infant is born dead after the twentieth week, and all cases in which a full-term infant is born in such a condition that its death must of necessity have occurred prior to the onset of labour—*i.e.*, all cases of macerated, putrid, or mummified infants. Of 16,654 infants born in the Rotunda Hospital during the mastership of Collins, 801 may be considered to have died *in utero*, a proportion of about 1 in 20. The most recent statistics of the hospital are somewhat similar. Of 11,203 infants born in the hospital, 393 may be considered to have died *in utero*—a proportion of 1 in 28·5. If we add to the number of dead-born infants half the number of abortions which occurred during the same period, a number which will not unfairly represent the cases in which the death of the embryo was the cause of the abortion, we get a total of 605 cases of intra-uterine death in 11,098 pregnancies, a proportion of 1 in 18·3. This is a very high proportion, and represents an enormous annual loss in the total potential population. It emphasises the importance of the present subject, and the necessity for determining the cause of such deaths and the means of, where possible, preventing their occurrence.

Ætiology.—The different causes of intra-uterine death may be divided into the following groups:—

(1) Pathological conditions of the mother.
(2) Pathological conditions of the father.
(3) Pathological conditions of the ovum which cannot be definitely allocated to one or other of the foregoing classes.
(4) Traumatic causes.
(5) Unascertained causes.

Pathological Conditions of the Mother.—The commonest maternal causes of fœtal death are perhaps syphilis, renal disease, endometritis, acute infectious diseases, and high temperature.

Syphilis is perhaps the most important of all causes, as it tends in many cases to destroy not alone one pregnancy, but—unless treated—every pregnancy. Its effects are more marked when the woman has been infected prior to conception, than if she is infected subsequently to conception. If conception and syphilis commence together, the death of the fœtus is the rule, but treatment is more potent in preventing it (Priestley*). *If syphilis is acquired after the mid-period of pregnancy, the child may escape altogether. Syphilis may bring about the death of the fœtus by causing extensive pathological changes in the fœtus itself, or in the placenta.*

2 Chronic renal disease is a common cause of fœtal death by causing the placental alterations which have been alluded to, and so interfering with the oxygenation of the fœtal blood and the supply of nutriment to the fœtus. The death of the latter may also result, in cases in which suppression of urine and uræmia have supervened, from the presence of toxins in the maternal blood.

3 Endometritis most usually terminates a pregnancy by causing the detachment and expulsion of the ovum, and not the primary death of the fœtus. It may, however, in many cases bring about the latter by causing a degeneration of the ovum and the condition known as a blood-mole or apoplectic ovum.

4 Acute infective diseases may bring about the death of the fœtus in two ways—either by the lethal effect upon the fœtus of the toxic condition of the maternal blood, or by the elevation of temperature by which the disease is accompanied. Attempts have been made to prove one or other of these to be the true cause of death, but it appears to be impossible and useless to endeavour to distinguish between them. There is no doubt that either factor in itself can bring about the death of the fœtus, and the particular factor which does so in any given case will depend upon which of them is the more strongly-marked characteristic of the disease from which the patient is suffering. If the toxic condition of the blood is more marked than the elevation of temperature, it will kill the fœtus before the latter has time to do so, and *vice versâ*.

5 The effects of elevation of temperature upon the fœtus have been summarised as follows by Runge,† who made many important experiments upon animals:—

(1) The temperature of the fœtus is habitually higher than that of the mother, and maintains this greater height when the mother's temperature becomes abnormal.

(2) The fœtus dies from the effects of increased temperature before such increase becomes fatal to the mother.

(3) The temperature of the mother, if only raised for a short period to 106·7° F., is fatal to the fœtus.

Among the rarer maternal causes of fœtal death are to be found the following:—

(1) Anæmia.—This in all probability causes the death of the fœtus by diminishing the amount of nutriment which is carried to it in the blood.

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* 'The Pathology of Intra-uterine Death,' p. 60. † *Archiv f. Gynäk.*, 1877.

(2) Phthisis.—This probably causes the death of the fœtus in the same manner as does anæmia.

(3) Diabetes.—Although the presence of a small amount of sugar in the urine in pregnancy is far from uncommon, the association of true diabetes with pregnancy is very fatal to the fœtus. Matthews Duncan* recorded nineteen cases of pregnancy in fourteen diabetic patients, in which seven of the infants died *in utero*, after reaching prematurity, and two more died a few hours after birth. The manner in which diabetes brings about the death of the fœtus is not very clear, but it is probably the poisoning of the fœtus by some toxin circulating in the maternal blood.

(4) Action of Certain Poisons.—Lead-poisoning is particularly prone to cause the intra-uterine death of the fœtus, and traces of the metal are said to have been found in such cases in the fœtal kidneys (Legrand). Poisoning by arsenic, savin, carbon monoxide and dioxide have also caused fœtal death.

(5) Eclampsia.—The intra-uterine death of the fœtus may almost be regarded as the rule in eclampsia, unless the fœtus is expelled within a comparatively short period of the onset of convulsions. The cause of its death is not definitely ascertained, but is most probably due to poisoning by the excessive quantity of toxins which are found in eclampsia in the maternal blood. It may also be due in some cases to the elevation of temperature which occurs during the convulsions (Winckel†). A third suggestion as to the cause of death is that the oxygenation of the blood is interfered with during the convulsions, and that the fœtus dies of asphyxia. It is probable that the actual cause of death differs in different cases, and that it depends upon which factor is the first to become sufficiently intense to cause death.

Pathological Conditions of the Father.—The most important of these is syphilis. Syphilitic disease of the father may result in the transmission of infected semen, which in turn produces an ovum affected with hereditary syphilis. If the syphilitic lesions are sufficiently marked, the death of the fœtus will follow, even though there has been no apparent infection of the mother.

Lead-poisoning of the father may also cause the intra-uterine death of the fœtus. The manner in which it does so is most obscure, but clinically the fact is well attested. It is said that tuberculosis of the father may affect the ovum in a somewhat similar manner.

Pathological Conditions of the Ovum.—In this group, we only include such pathological conditions as cannot, in the present state of our knowledge, be definitely attributed to either maternal or paternal causes. The chief of these are vesicular degeneration of the chorion, abnormal development of the fœtus, and interruption of the circulation in the funis, due to the abnormal length or development of the latter.

Traumatic Causes.—Violent blows on the abdomen of the mother and falls may cause the death of the fœtus by direct violence or by causing the detachment of the placenta.

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* *Trans. Lond. Obstet. Soc.*, 1882.

† 'Berichte und Studien.'

Unascertained Causes.—It is not uncommon to meet with patients with whom each successive fœtus dies during the last two or three months of pregnancy. Such cases have come to be spoken of as cases of 'habitual death of the fœtus.' In many instances, it is possible to determine the cause, which is usually found to be syphilis—maternal or paternal—or perhaps anæmia, tuberculosis, or inflammatory conditions of the uterus. In some cases, however, it is impossible to ascertain any cause for the death of the fœtus. The latter dies and is expelled, but no lesion can be found to account for its death. It would seem as if the mother was able to furnish it with the necessary amount of oxygen and nutriment until it reached a certain age, and that then she became unable to do so. The term 'habitual death of the fœtus' should be kept for such cases, as to apply it to those in which the cause of death is known is inadvisable, as it tends to obscure the important point—*i.e.*, the cause of the recurrent deaths.

Symptoms and Diagnosis.—If the embryo or fœtus dies, the ovum in the great majority of cases is expelled. In some cases, however, it is retained, and then the condition known as *missed abortion* or *missed labour* results. In missed abortion, the retained ovum usually continues to receive some blood-supply from the uterus, and may become semi-organized, and form what is known as a placental or fibrinous polypus. In other cases, saprophytic bacteria may gain entrance to the uterus, and the retained ovum become putrid. In cases of missed labour, in which condition we have to deal with a more or less fully formed fœtus, various changes may occur in the latter, the three chief of which are maceration, mummification, and putrefaction, and, according as one or other of them occurs, the symptoms will vary.

Maceration is dependent on three conditions:—(*a*) Fluid surroundings; (*b*) warmth; (*c*) an absence of putrefactive organisms. Under these conditions, the fœtus becomes œdematous and water-logged, its skin peels off in patches, the ligaments of the bones soften and permit abnormal mobility, and the viscera become softened and œdematous, and undergo a fatty degeneration. The cord in some cases increases in size, owing to infiltration with liquor amnii, in other cases it becomes flaccid and diminished in size, owing to disappearance of the Whartonian jelly. The placenta remains longer unaffected than the fœtus. Finally, however, it atrophies, and becomes of a greyish colour, as a result of fatty degeneration.

It is difficult to determine, by the degree of maceration present, how long a fœtus has been dead, as the rapidity with which the changes take place probably varies considerably in different cases. According to Ruge, Lempereur,* and others, who have investigated the question, there is very little change during the first two days after death, save an increase in flaccidity, slight discoloration of the tissues, and a slight infiltration of the cord. At the end of eight days, the cranium becomes more flaccid owing to softening of the ligaments; the skin peels off, and blebs form over various parts of the body save the head. At the end of ten days, maceration is considerably more marked; the epidermis is stripping even off the face; and the scalp is infiltrated, but still adherent. To the fœtus at this stage, the term *fœtus sanguinolentus* was given by Ruge. It is difficult to believe that in some cases these changes are not produced more rapidly, as it is not uncommon to meet a considerable degree of maceration in an infant which, according to the history of the mother, was alive twenty-four hours before. The gross macroscopical changes are in the main due to the water-logging of the tissues, and the rate at which this takes place must largely depend upon the amount of liquor amnii present and upon the intra-uterine pressure. The practical importance of this is evident in medico-legal cases, where it may be necessary to attempt to fix the date at which the death occurred. In such cases, an opinion based on the degree of maceration should be most guarded.

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* Thèse de Paris, 1867.

Mummification of the fœtus is an unusual occurrence, and is akin to 'the preserving of meat in brine.' It is essentially a drying-up or desiccative change, and is probably associated with a comparative absence of liquor amnii. The fœtus, instead of becoming œdematous, shrinks, and gives up the water in its tissues. This change is particularly prone to occur in the case of a dead twin. In such cases, the living twin as it grows may press the dead one against the uterine wall, thus flattening it out and producing the condition known as *fœtus compressus* or *papyraceus*.

Putrefaction of the fœtus calls for no special remarks. The changes the fœtus undergoes are akin to those associated with putrefaction of any other animal tissue, and in consequence of them gas collects in the uterus.

The symptoms to which the retention of a dead fœtus gives rise have been already described in the chapter on obstetrical diagnosis, and need not be again referred to. The diagnosis of this condition has also been dealt with in the same place.

Treatment.—The prophylaxis of intra-uterine death of the fœtus is a matter of considerable importance, especially in those cases in which the cause of the condition is recurrent and affects successive pregnancies. As the treatment proper to adopt has been described already in all cases in which the recurrent death of the fœtus is due to a specific and ascertainable cause—such as syphilis, renal disease, or anæmia, it is unnecessary to again enter into it; and here we need only refer to those cases which we have mentioned to which the term 'habitual death of the fœtus' is by preference applied, and in which the cause of death is still obscure.

The treatment of these cases has been in the past, and still is, largely governed by the belief that the cause of death is to be found in an inability on the part of the mother to afford the fœtus sufficient oxygen or nutriment after it has reached a certain stage of development. Accordingly, the usual treatment adopted consists in inducing labour a short time before the period of pregnancy at which the fœtus habitually dies. This treatment is, of course, only applicable in cases in which the fœtus habitually dies after it has become viable, that is, after the end of the seventh month, and it has also the disadvantage that, though the fœtus may be saved temporarily from an otherwise impending death, it runs considerable risk of dying after its birth owing to its prematurity. Still, in some cases, success has been attained, and, consequently, if all other means fail, the induction of premature labour should be tried as a last resource.

More than fifty years ago, the late Sir J. Y. Simpson recommended the administration of chlorate of potassium in these cases, on the principle that it would give up its oxygen and so increase the quantity of that essential element in the maternal blood, and thus allow the fœtus to obtain the necessary quantity even in the case of a seriously degenerated placenta. This effect of chlorate of potassium is, however, universally denied, as the drug is excreted unchanged from the body. Jardine* of Glasgow has, however, of late again administered the drug in these cases, and with apparently beneficial results. One case which he records is of special interest. Of eight pregnancies, five terminated in miscarriages, or in the intra-uterine death of the fœtus, while in three the fœtus was born alive at term. In the five fatal pregnancies, no treatment was adopted. In the three instances in which the fœtus lived, chlorate of potassium was administered regularly during the course of pregnancy. Jardine administers the drug in doses of ten grains three times a day, from the third month onwards. He does not endeavour to explain its action, save to say that he considers it has a beneficial effect upon the endometrium, and he points to his cases as ample evidence that the drug exerts no deleterious effect upon the mother. In view of Jardine's experience, chlorate of potassium deserves a trial, especially as the present treatment of habitual death of the fœtus is so unsatisfactory.

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* *Brit. Med Journ.*, October 11, 1902, p. 1137.

CHAPTER VII

ABORTION. MISCARRIAGE. PREMATURE LABOUR. DELAYED LABOUR.

Abortion—Threatened Abortion—Cervical Abortion—Incomplete Abortion—Complete Abortion—Missed Abortion. Miscarriage—Ætiology—Symptoms—Treatment. Premature Labour—Causes—Symptoms—Treatment. Delayed Labour—Symptoms—Diagnosis—Treatment.

ABORTION.

By the term 'abortion' is meant the expulsion of the ovum from the uterus before the complete formation of the placenta—that is, before the commencement of the fourth month.

Frequency.—The relative frequency of abortion is a matter on which the statistics of different observers differ considerably. This may be accounted for by the difficulty of obtaining a reliable history from women of their previous pregnancies, and the unreliable nature of hospital statistics in this respect, inasmuch as a far larger proportion of women seek the help of hospitals in full-term labour than in abortion. Priestley* obtained the pregnancy history of 400 private patients in whom the evidence was 'distinct and reliable.' All of these women had reached their fortieth year, and hence the history included for most of them the whole of the child-bearing period of life. These 400 women had been pregnant, collectively, 2,325 times, and there had been 542 abortions. The proportion of abortions to children was therefore about 1 to 3·2, while the proportion of abortions to pregnancies was about 1 to 4·2. Of the 400 women, 152 had never aborted, and 52 had never borne a living child. The average number of abortions for each woman was thus 1·35, of living children 4·46, and of pregnancies 5·81. These figures contrast strikingly with the figures obtained from the statistics of the Rotunda Hospital. In that institution, amongst 20,000 patients there were 707 abortions, a proportion of 1 to 28·28. This figure is, as is only to be expected for the reason given, very much below the normal proportion.

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* 'The Pathology of Intra-uterine Death,' p. 8.

Ætiology.—The causes of abortion may be divided into two groups:—

(1) Causes which affect the attachment of the ovum to the uterus.

(2) Causes which bring about the death of the embryo.

Causes which affect the Attachment of the Ovum to the Uterus.—Four important causal factors of abortion are included in this group:—Diseases of the decidua, or fœtal membranes; interference with the development of the uterus; direct contraction-producing agents, or oxytocics; and traumata.

a Diseases of the decidua, or fœtal membranes, are perhaps the commonest causes of abortion. In some cases, as has been already seen, they may bring about the death of the embryo, and consequently fall into the second group; but in the greater number of cases they cause abortion by interfering with the normal relations of the decidua and the ovum. The most common pathological conditions met with are decidual endometritis, syphilis of the ovum, and commencing myxomatous degeneration of the chorion. Malignant disease of the endometrium may perhaps be added to this group. It is, however, a most uncommon cause, as its presence usually ensures sterility.

b Interference with the development of the uterus is also a common cause of abortion. The commonest conditions which interfere with development are mal-positions; mal-development and tumours of the uterus; abdominal and pelvic tumours, other than uterine, which press upon the uterus; and pelvic adhesions.

c Direct contraction-producing agents, or oxytocics, are to be found in certain drugs, as savin, ergot, carbonic acid gas, excessive physical exercise or mental excitement, and excessive sexual intercourse. The foregoing are extremely rare causes of abortion. The drugs mentioned in all probability only exercise an oxytocic effect when given in poisonous doses. A sufficient accumulation of carbonic acid gas in the maternal blood to produce contractions probably only occurs under conditions which produce the partial or complete asphyxia of the mother. Excessive physical exercise or mental excitement will in all probability only cause abortion when occurring in association with a diseased condition of the endometrium or ovum, when it may be the determining cause. Excessive sexual intercourse probably only produces abortion under similar circumstances.

d Under the head of traumata, are included all causes which can produce a sudden detachment of part of or of the whole ovum. The chief of these are falls; blows on the abdomen; the passage of instruments into the uterus; sudden increase of blood-pressure, as may occur in consequence of severe mental emotion or excitement; convulsions; vomiting; straining, or sudden exertion of any kind.

Causes which bring about the Death of the Embryo.—These causes have been already fully discussed, and need not be recaitulated. Once the embryo is dead, the ovum acts as a foreign ody, and induces uterine contractions. The death of the embryo s perhaps the next commonest cause of abortion to decidual endometritis.

If the foregoing list of causes of abortion is studied, the importance and truth of Hegar's dictum that 'the causes of premature expulsion of the fœtus are generally to be dated further back than is usually done' will be evident. Almost all the immediate causes which have been mentioned are secondary to some primary pre-existing cause, and, if the tendency to abortion is to be cured, it is the primary cause which must be ascertained and removed. The two commonest causes of abortion are, as we have stated, decidual endometritis and death of the embryo. Decidual endometritis is not a primary condition, but is due to some pre-existing condition, as endometritis, displacements, syphilis, renal disease, etc. Similarly, the death of the fœtus is also due to some pre-existing condition—syphilis, toxic condition of the maternal blood, constitutional disease of the mother, etc. It is to these pre-existing conditions that we must direct our attention, if we hope to prevent the occurrence of abortion, and hence the extreme importance of recognising their share in the ætiology of abortion.

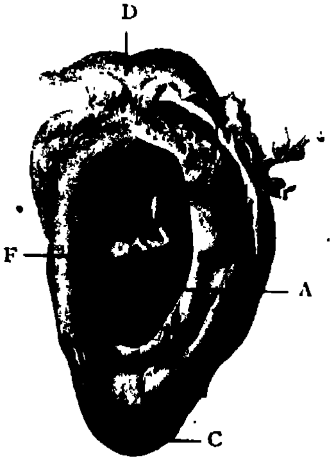

FIG. 286.—AN EXPELLED OVUM EMBEDDED IN THICKENED DECIDUA.
F, Fœtus; D, portion of decidua reflexa; A, amniotic cavity; C, the lower or cervical pole.

Varieties.—It is customary to divide abortions clinically into several groups. The most common classification to adopt is that which divides abortions into two groups—threatened abortion and inevitable abortion. By threatened abortion is meant the occurrence of uterine hæmorrhage and pain sufficiently marked to show that some interference with the attachment of the ovum to the uterus has occurred, but not sufficiently marked to preclude the possibility of their ceasing and the pregnancy continuing. By inevitable abortion, on the other hand, is meant the occurrence of symptoms sufficiently marked to show that there is no hope of the pregnancy continuing. This classification has no great advantages. It is not any more scientific than the one we propose to adopt, and, inasmuch as it is difficult to at once allocate every case of abortion into one or other group, it is not of any very great practical value. An abortion is never inevitable until so large a part of the ovum is detached that its continued life is impossible, and it is impossible in many instances to say that this has taken place. The classification which we shall adopt is as follows, and we may preface it by saying that the meaning attached to the term 'threatened abortion' is not that which has been given above:—

(1) Threatened abortion.
(2) Cervical abortion.
(3) Incomplete abortion.
(4) Complete abortion.
(5) Missed abortion.

THREATENED ABORTION.

Threatened abortion is the term applied to the onset of pain, hæmorrhage, and a varying degree of dilatation of the cervix, in a patient during the first three months of pregnancy.

Symptoms.—The woman believes herself to be pregnant, and the various subjective symptoms of pregnancy are present. The earliest symptom of the threatening to abort is usually an attack of uterine hæmorrhage, accompanied or not by pain due to contraction of the uterus. The character and amount of the hæmorrhage differs in different cases. It may come on suddenly and violently, or it may appear gradually and be slight in amount. It may be recurrent, or there may be but a single attack. Most frequently, it occurs as recurrent attacks, at each of which the patient may lose from two to ten ounces of blood. Similarly, the strength of the uterine contractions, and hence the intensity of the pain, vary greatly. In cases in which the threatening to abort is slight, there may be no pain at all, and in such cases the threatening to abort will probably pass off. In other cases, the pain may be most severe, and in them the ovum will be most probably expelled. It must not, however, be considered that the occurrence of uterine contractions necessarily means that the abortion is 'inevitable.' It is probable that in such cases the ovum will be expelled, but, on the other hand, in many cases the contractions pass off under suitable treatment, and the pregnancy continues. The degree of dilatation of the cervix depends upon the strength of the contractions which have occurred, and the length of time for which they have been occurring. In all cases where there has been any considerable degree of hæmorrhage, the canal will be more patulous than normal, and the cervical tissue softer. If, however, contractions are superadded, and the ovum is in part or altogether detached, the internal os will commence to dilate, and then, in turn, the remainder of the cervical canal. If any part of the ovum has passed through the internal os, then the term 'inevitable abortion' may be applied to the condition, if so desired.

Diagnosis.—The diagnosis of threatened abortion is made by the history of the patient and the results of a bi-manual examination. Two points have to be determined:—First, the existence of pregnancy, and secondly, the fact that the hæmorrhage is coming from the uterus. Once the existence of pregnancy is determined, the differential diagnosis lies between threatened abortion, extra-uterine pregnancy, incomplete abortion, and vesicular mole. We propose to postpone the discussion of the differential diagnosis until the chapter on the hæmorrhages of pregnancy, as the student will be in a better position to understand the different points in the diagnosis at that stage.

Treatment.—If we divide abortions into the old classification of threatened and inevitable, the question of treatment is very simple, and the only difficulty lies in allocating each case to one or other class. Once the allocation has been made, then, in threatened abortion, we endeavour to prevent the abortion from occurring, in inevitable abortion we endeavour to hasten its occurrence. In practice, however, the difficulty of allocating each case to one or other class is very considerable. An abortion can only be regarded as inevitable when so large a portion of the ovum is detached that the further life of the latter is impossible. Clinically, it is in many cases impossible to state that this has happened, and all that can be done is to allocate the extreme cases to one or other group, and to leave the border-line cases to be determined by future events. Thus, if a patient has hæmorrhage, only slight pain, and no dilatation of the cervical canal, the abortion is only threatened. If, on the other hand, a portion of the ovum actually protrudes through the internal os, then the abortion is said to be inevitable. Between these two classes of case, however, are found a considerable proportion of abortion cases, in which it is impossible to say whether the abortion is 'threatened' or inevitable. What can, however, always be determined regarding these cases is whether they require palliative or active treatment. In many cases in which a patient has a profuse attack of hæmorrhage, the pregnancy might continue to term, if allowed to do so, but the condition of the patient is such that we should not be justified in allowing her to run the risk of a recurrence of the hæmorrhage. In such a case, the abortion strictly speaking is not 'inevitable,' but, practically, we must adopt active treatment and empty the uterus. Again, on the other hand, an ovum may be in great part detached, but still lying inside the uterus, and causing no great hæmorrhage or pain. The abortion is 'inevitable,' though the fact cannot be clinically determined. We do know, however, that the patient presents no symptoms calling for active treatment, and, hence, we adopt palliative treatment in the hope that the pregnancy may continue, or that, if it is doomed, the uterus may itself expel the ovum. Accordingly, as we regard all cases of abortion as threatened in which the entire ovum still remains in the uterine cavity, we shall subdivide these cases into two classes:—Cases that require palliative treatment; cases that require active treatment.

In the first class are placed all cases in which the symptoms of the patient are not urgent, and in which we hope to be able to allow the pregnancy to continue, if it will do so. In the second class are placed all cases in which the condition of the patient is, such, in consequence of the amount of blood she has lost, that we do not consider it safe to allow her to lose more.

Palliative Treatment.—The palliative treatment of threatened abortion may be stated in general terms to consist of measures calculated to check hæmorrhage and uterine contractions. The patient is kept at rest in bed, in the recumbent posture, and all sudden movements and straining are forbidden. Following the advice of Atthill,* and also influenced by our own experience of the use of the drugs, we consider it advisable to administer ergot and strychnine in all cases in which there is hæmorrhage, but in which there are no uterine contractions. The advisability of the use of ergot in these cases has been already discussed. It is improbable that the drug tends to produce uterine contractions in cases in which they have not already started, while, on the other hand, it appears to exercise a tonic effect on the uterine muscle. If, however, uterine contractions have commenced, the administration of ergot may increase their force, and so may tend to hasten the expulsion of the ovum. The drugs are usually administered as a pill or tablet containing one-thirtieth of a grain of strychnine, and three grains of extract of ergot, the pill to be taken twice or three times in the day, or in the form recommended by Atthill. Hydrastis Canadensis has been also recommended in these cases. Its action is, however, very slight, and the benefit derived from it does not appear to be great. Tincture of opium by the mouth, or hypodermic injections of morphia, may also be administered, with the double object of relieving any pain from which the patient is suffering, and of ensuring mental and physical rest.

Active Treatment.—The active treatment of threatened abortion consists in emptying the uterus, with the object of preventing further hæmorrhage. The emptying of the uterus can be carried out in two ways. The ovum can be detached and removed by the finger or a curette, or uterine contractions may be induced by plugging the vagina or the uterine cavity with iodoform gauze, and the uterus made to expel the ovum itself.

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* *Op. cit.*

The immediate removal of the ovum by expression, by the finger, or by the curette, is the treatment of choice in all cases in which it can be carried out. Expression of the ovum is only possible when the ovum is detached, and the cervical canal sufficiently dilated to allow it to pass through. In such cases, expression will succeed, and will obviate all intra-uterine interference. Expression is performed bi-manually, the position of the hands being identical with their position when making a bi-manual examination of the body of the uterus. The patient is placed in the dorsal position, by preference across the bed, or on a table. Two fingers of the right hand are then passed into the vagina and placed beneath the body of the uterus, that is to say, in the anterior fornix if the uterus is normal in position, in the posterior fornix if it is retroverted. The other hand is then placed on the abdominal wall, and the fingers are depressed until they come down on the superior surface of the uterine body. Then, by pressure on the body with the fingers of both hands, the ovum is driven out of the uterus into the vagina. The procedure is then repeated, with the object of expressing any clots that have been left behind.

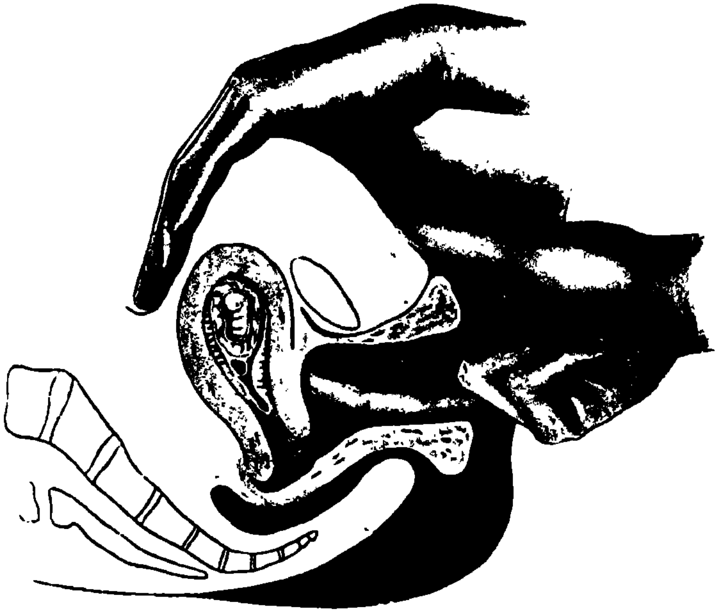

Fig. 287.—The Bi-manual Method of expressing a Detached Ovum.

The removal of the ovum by the finger is carried out as follows:—The fingers of the right hand are passed into the vagina, and the left hand is placed as before upon the superior surface of the uterine body. One finger of the right hand—usually the index finger—is then passed into the uterus, and the ovum rapidly detached by sweeping the finger round the uterus between it and the uterine wall. As soon as it has been completely detached, the finger is removed, and the ovum expressed, as has just been described.

The only advantages, which, in our opinion, a curette possesses over the finger for the removal of the ovum, are that it can be used when there is a less degree of dilatation of the cervix, and that it is easier to sterilise than is the finger. On the other hand, in the case of an unskilled operator, it is more dangerous than is the finger, as it is by no means difficult to pass it through the soft uterine wall, and in all cases the finger is more sensitive, and enables the operator to form a better opinion as to whether the uterus has been completely emptied. Further, if rubber gloves are worn, the finger is as aseptic as is the curette. In abortion cases, a blunt curette of large size must always be used, as, with a sharp curette, it is an easy matter to scrape away the softened fibres of the uterine wall. The curette most suited for the purpose is that known as Rheinstadter's flushing curette. This is a blunt curette of considerable size, and with a hollow handle through which a stream of water can be made to flow while the curette is in use. By this means, all débris is washed out of the uterus. The operation of curetting will be described in its proper place.

Plugging the vagina permits, or indeed encourages, the accumulation of blood above the plug in the uterine cavity. This in itself is not of any great importance, so long as the uterus is still occupied by an intact ovum. If, however, any part of the ovum has come away, and if putrefactive organisms have gained entrance into the uterine cavity, then the result of damming up the escaped blood is to increase very materially the dangers of intra-uterine decomposition. It is not always possible to be sure that some portion of the ovum has not come away, and, consequently, plugging the vagina is not an ideal treatment.

Plugging both the vaginal and the uterine cavity with iodoform gauze was first recommended by Dührssen,[*] and constitutes a most valuable mode of treatment. It is free from the disadvantages which are associated with the use of the vaginal plug alone, and, in fact, it rather tends to sterilise the uterine cavity than to promote its infection. Further, it can be adopted when there is insufficient dilatation of the cervix to allow the introduction of the finger or curette, it is easy of accomplishment, it checks the hæmorrhage at once, and it causes the expulsion of the ovum within twenty-four hours.

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[*] 'A Manual of Obstetrical Practice,' English edition, p. 118.

The method of tamponing the uterus or vagina will be described in its proper place. It is sufficient to say here that the material used for tamponing must be impregnated with an antiseptic, as a simple aseptic material becomes offensive in a very short time owing to the decomposition of the discharge which soaks into it. The plugging is left *in situ* for twenty-four hours, and then removed, unless there is an indication for its earlier removal. Usually, after its removal, the ovum is found in the upper part of the vagina, but, even if it has not been expelled from the uterus, the os is now sufficiently dilated to enable it to be expressed or removed.

The treatment of the patient after the uterus has been emptied is identical with that of complete abortion.

CERVICAL ABORTION.

A cervical abortion is the term applied to the condition which occurs when the ovum is expelled into the cervical canal, and becomes incarcerated there as a result of the failure of the external os to dilate.

Symptoms.—The symptoms of the case are at first those of threatened abortion. Later, when the ovum has been completely expelled into the cervical canal, the uterus contracts above it and all hæmorrhage ceases, save a varying amount of red or brownish discharge, which may be fœtid if the ovum has commenced to decompose. On examination, the alteration in shape of the cervix is the first thing noticed. The cervix has lost its usual conical form, and become ballooned out so as to be almost as wide as it is long. The external os is felt as a small orifice, which just admits the pulp of the tip of the examining finger. It has rigid parchment-like edges, and presenting at it can be felt a firm globular mass.

Diagnosis.—The only condition for which cervical abortion can be mistaken is that in which a fibrous polypus has been expelled from the cavity into the cervical canal, and lies there in the same manner as does a cervical abortion. The physical signs of the two are, as is only to be expected, identical, and the diagnosis is only to be made from the history of the case. The treatment in either case is identical, and if a correct diagnosis cannot be made from the history, it will be made as soon as the mass in the cervical canal has been removed.

Treatment.—The treatment consists in dividing the tissues of the cervix in such a manner as to increase the size of the os externum, then in expressing the ovum, washing out the uterus, and suturing the incision. The incisions are made bi-laterally, and extend upwards for half to three-quarters of an inch, or farther if necessary. As a rule, a single silkworm gut or catgut suture in each incision will suffice to bring the edges together. Each suture is passed from the vaginal surface of the cervix, and does not pass through the mucous membrane lining the canal.

INCOMPLETE ABORTION.

Incomplete abortion is the term applied to the condition when part of the ovum has been expelled, and the remainder is retained in the uterus.

Symptoms.—1 The early symptoms of the case are again those of threatened abortion;2 but, in addition, there may or may not be a history of the expulsion of some part of the ovum. 3 The hæmorrhage, which ushered in the abortion, gradually ceases, and is replaced by a brownish discharge, which may become fœtid if the portion of ovum which was left behind decomposes. 4 Recurrent attacks of hæmorrhage, some of which may be of such severity as to threaten the life of the patient, may occur at any time, due to the separation of additional portions of the ovum. 5 If the intra-uterine decomposition is allowed to continue, the patient will suffer from the effects of the absorption of ptomaines, and present all the symptoms of sapræmic intoxication. 6 Also, the intra-uterine infection may extend to the tubes, and thence to the peritoneal cavity, or to the peri-uterine connective tissue, giving rise to pelvic peritonitis or parametritis.

Diagnosis.—In making the diagnosis of an incomplete abortion, two points have to be determined:—First, the existence of an intra-uterine pregnancy; and, secondly, the fact that a part of the ovum has been expelled. A ruptured tubal pregnancy and an incomplete abortion are particularly liable to be mistaken for one another. The differential diagnosis will be discussed under the head of tubal pregnancy.

Treatment.—The treatment of an incomplete abortion may be summed up in a few words. The uterus must be emptied at once, and the incomplete abortion turned into a complete one. The method to be adopted of emptying the uterus depends upon the period which has elapsed since the coming away of the expelled portion of the ovum, and also upon the condition of affairs present.7 If the case is seen shortly after the first portion of ovum was expelled, the treatment is identical with the active treatment of a threatened abortion. The remains of the ovum are, if possible, expressed, and if that is not possible, they are removed with the finger or curette according to the size of the cervical canal. If the latter is insufficiently dilated to permit of this, the uterine cavity and vagina should be plugged with iodoform gauze. In no case should the vagina alone be plugged in a case of incomplete abortion, owing to the danger of decomposition occurring in the uterine cavity above the plug.9 If the case is not seen for some days after the expulsion of the first portion of ovum, it may be necessary to dilate the cervical canal with Hegar's dilators or laminaria tents. As soon as the necessary degree of dilatation is obtained, the retained fragments are removed with the finger or curette. In all such cases, a blunt curette is used. 3 If, however, a fortnight or more has elapsed since the expulsion of the ovum, a sharp curette may be used, as by this time the uterine wall has returned somewhat to its former consistency, and, moreover, it may be impossible at this stage to remove retained fragments by means of a blunt curette, so closely have they become incorporated with the uterine wall.

It should scarcely be necessary at the present day to condemn the expectant treatment of incomplete abortion; but as some customs die hard, it is perhaps safer to do so. The expectant treatment of incomplete abortion was, in the past, the usual treatment adopted in these cases, and was even recommended by so great an authority as Winckel. It consisted in waiting in all cases of incomplete abortion until one of three things happened:—

(1) The remainder of the ovum came away. This was the termination hoped for, and when it occurred the advocates of the treatment pointed out how successfully they had avoided any intra-uterine interference.

(2) The ovum decomposed.

(3) The patient lost as much blood from repeated hæmorrhages as was considered safe.

If the second or third termination occurred, the uterus was then emptied; but unless they occurred, the condition was allowed to persist. The natural result of such a line of treatment is that in a certain proportion of cases the remainder of the ovum comes away spontaneously, and the patient gets well. In other cases, however, intra-uterine decomposition occurs, and the infection may extend to the tubes, the pelvic peritoneum, or the connective tissue, and the patient become a chronic invalid. In still other cases, the occurrence of sapræmic intoxication, in a patient weakened by repeated hæmorrhages, has proved fatal. This line of treatment must be absolutely condemned. The proportion of cases in which subsequent interference is not required is small, and in the cases in which interference is necessary, it is more difficult to carry out, the longer it is postponed, owing to the closure of the cervix. The additional risk, from sapræmia and recurrent hæmorrhages, to which the patient is subjected by waiting is considerable.

COMPLETE ABORTION.

Complete abortion is the term applied to the expulsion of the entire ovum.

Symptoms.—The initial symptoms are those of threatened abortion. These may persist for a varying number of hours, and then the ovum is expelled.

Diagnosis.—The diagnosis of complete abortion is made when the expelled ovum is found to be complete. If, however, the expelled matter has been thrown away before the medical man has had an opportunity of examining it, it is often difficult to be sure that the uterus is empty. The diagnosis of such cases will be subsequently discussed.

Treatment.—The treatment to be adopted after complete abortion is almost identical with the treatment adopted during the puerperium. 1 The patient is kept at rest in bed for at least five days, or until the discharge has completely ceased. If possible, she should remain in bed for eight days. 2 If the discharge continues longer than is right, or is unduly profuse, ergot may be administered in drachm doses of the liquid extract twice a day, or as a pill in combination with strychnine. 3 In all cases of abortion, the patient should be directed to visit her medical adviser in from three to six weeks after the occurrence of the abortion, and a bi-manual examination should then be made to determine the presence or absence of any local conditions which may have given rise to the abortion, such as uterine displacements. If such conditions are found, they must be remedied.

MISSED ABORTION.

Missed abortion is the term applied to the retention of the ovum in the uterus after the death of the embryo.

Symptoms.—The symptoms of missed abortion are practically identical with those of incomplete abortion, save that there may not be any hæmorrhage. 1 There is a brownish discharge from the vagina, and this will become fœtid if decomposition of the ovum occurs. 2 The uterus diminishes in size, 3 and the various subjective and objective symptoms of pregnancy pass off. 4 The patient complains of various subjective sensations which are due to the absorption of ptomaines from the dead ovum, and which have been already described. P 263

Diagnosis.—The diagnosis is made from the history of the patient and the results of a bi-manual examination. If the nature of the case is not at first clear, it may be necessary to wait for a little, and then to repeat the examination. The alterations in the uterus, if the ovum is dead, can then be usually determined. The occurrence of a well-marked brown discharge coming from the uterus is almost positive proof of the death of the ovum.

Treatment.—1 The treatment in these cases consists in dilating the cervical canal and removing the ovum, either with the finger or the curette. The usual method of inducing abortion—*i.e.*, puncturing the membranes—is not sufficient in cases such as these where the death of the ovum has failed to provoke uterine contractions. Dilatation of the cervix may sometimes be carried out by means of Hegar's dilators, but in most cases it will be necessary to first insert laminaria tents in order to obtain the required degree of dilatation. 2 If the means of dilatation are not at hand, the uterine cavity may be plugged with iodoform gauze. By this means, uterine contractions will probably be induced, and at any rate some degree of dilatation of the cervix will be obtained. The gauze is left in for twenty-four hours.

MISCARRIAGE

Miscarriage, or *partus immaturus*, is the term applied to the expulsion of the ovum between the time at which the placenta is formed and the time at which the fœtus becomes viable, that is to say, between the beginning of the fourth and the end of the seventh month.

Ætiology.—The causes of miscarriage are identical with those of abortion, with the addition of placental disease and detachment.

Symptoms.—Miscarriage differs from abortion in that, while as a rule in abortion the ovum is expelled entire in a single stage, in miscarriage the process of expulsion is identical with that of full-term labour, and the ovum is expelled in two stages, the fœtus being driven out first and then the after-birth and membranes. Exceptions to this rule are not uncommon, and it occasionally happens that the ovum is expelled intact. In a series of 389 cases collected at the Clinic Baudelocque, in which the ovum was expelled during the fourth, fifth, and sixth months, in 23 instances it was expelled entire.[*]

The three chief points of difference between miscarriage and full-term labour are, first, that as the fœtus is so small there is little or no mechanism of labour in the ordinary sense of the word; secondly, that, since for the same reason there is no accommodation between the uterus and the fœtus, abnormal presentations are relatively more common than at full term; and, thirdly, that retention of the placenta is a more common occurrence.

The increased proportion of abnormal presentations is well shown by the statistics published by Brion.[†] In the following table his statistics are compared with the usual proportion of the same presentations at full-term, and with the proportion as found when all cases of labour are grouped together:—

Age of Pregnancy.	Percentage of Presentations.		
	Cephalic.	Podalic.	Shoulder.
4 to 5 months[‡] - - - -	40·00	47·27	12·72
5 to 6 months[‡] - - - -	40·90	46·90	6·19
6 to 7 months[‡] - - - -	56·10	40·57	3·68
Full-term[§] - - - -	97·89	1·61	0·50
All cases[‖] - - - -	96·33	3·11	0·56

The cause of placental retention is usually to be found in the non-separation of the placenta from the uterus, owing to the presence of more dense adhesions than usual, or to the fact that the small size of the placenta renders its detachment by the uterine contractions more difficult. Retention of the placenta in these cases may, however, be sometimes due to its incarceration, owing to the closure of the uterine orifice. In cases of immature birth, the cervical tissues are apparently more irritable and contract again more rapidly than at full term. One result of this may be retention of the placenta, and another result is interference with the expulsion of the fœtus. The latter difficulty is particularly prone to occur in cases in which the fœtus presents by the breech. In such cases, expulsion proceeds satisfactorily until all but the head has left the uterus. The cervix may then contract down upon the neck, and prevent the descent of the head.

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[*] Brion, 'Étude Critique sur 530 cas d'Avortement,' Thèse de Paris, 1892.
[†] *Op. cit.* [‡] Brion. [§] Ribemont-Dessaignes. [‖] Schroeder

Treatment.—In view of the points of difference which have been mentioned above, there are accompanying slight differences in the treatment of a miscarriage as compared with that of a full-term labour; in all main points, however, the treatment of the two is identical. It is never necessary to correct a malpresentation save in the case of a shoulder presentation during the sixth and seventh month. If the pelvic pole of the fœtus presents, the arms should be encouraged to slip upwards beside the head and should not be brought down, as when the arms are alongside the head the cervix is prevented from contracting round the neck, and so delaying the birth of the head. If the placenta is not expelled within half an hour of the birth of the fœtus, and cannot be expressed, there is little object in waiting any longer, and it must be removed manually. This is frequently a troublesome process, in consequence of the cervical canal having partially closed so as to prevent the introduction of more than one or at most two fingers into the uterus.

If the cervix contracts round the neck, traction on the body may succeed in drawing the head through. The force of the traction must entirely depend upon the condition and size of the fœtus, as in the case of a dead fœtus too vigorous traction will readily result in pulling the body away from the head. If such an accident occurs, the head may be expressed, or, if small, may be caught and pulled through the cervical canal with a pair of ovum forceps, or similar contrivance. If it is large, the finger may be passed into the mouth and the head hooked down. Failing this, it may be necessary to seize it with a cranioclast, and thus extract it, but the necessity for such a procedure is very rare.

The after-treatment of a miscarriage is identical with that of a full-term labour. As in the case of abortion, the patient should be examined in from four to six weeks after the expulsion of the ovum in order to determine, if possible, the cause of the occurrence.

PREMATURE LABOUR

Premature labour, or *partus prematurus*, is the term applied to the expulsion of the ovum after the fœtus has become viable, but before full term, *i.e.*, after the end of the seventh month, and before the end of the tenth.

Causes.—Premature labour may be caused by most of the conditions or diseases which give rise to abortion. The most important of these are the intra-uterine death of the fœtus, syphilis, Bright's disease, and traumatisms. In addition, there are other causes which have to be taken into account. The chief of these are detachment of the placenta, usually as a result of its insertion in the lower uterine segment; overdistension of the uterus, as in hydramnios and multiple pregnancy; premature rupture of the membranes; and eclampsia.

Symptoms.—The symptoms of premature labour differ but little from those of full-term labour. The stage of dilatation of the cervix may be somewhat prolonged, inasmuch as the cervical tissues have not reached that degree of softness which they normally reach at full term. On the other hand, on account of the small size of the fœtus its expulsion is more rapid. Malpresentations are slightly more common than at full term.

Treatment.—The treatment of the case is identical with that of normal labour. The infant must be kept warm after birth, and should, if possible, be placed in an incubator. The management of a premature infant will be subsequently described.

DELAYED LABOUR

Delayed labour, or *partus serotinus*, is the term applied to labour when it occurs more than forty-one weeks after conception. This is not a condition to which it is necessary to refer at any length, as labour under these circumstances does not differ from labour at full-term unless the fœtus continues to grow, and so offers an obstacle to delivery owing to its increased size.

Connected with *partus serotinus* is another and very rare condition, known as 'missed labour.' This term was first introduced by Oldham,* and was applied by him to the condition which results when labour does not occur spontaneously. In such a case, the fœtus dies, and the liquor amnii is gradually absorbed. Finally, if the ovum is retained for sufficient length of time, one of the various changes which have already been described may take place in the fœtus—maceration, mummification, or, if putrefactive bacteria gain entrance to the uterus, putrefaction. If the fœtus is retained for a very long time, a deposit of lime salts on the epidermis may lead to the formation of a calcified covering which invests the fœtus. To this condition the term *lithopædion* has been applied. In other cases of long retention, the fœtus becomes completely disorganized, and is found as a mass of adipocere and bones.

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* *Path. Trans.*, vol. i.

Symptoms.—1The symptoms to which missed labour gives rise are the result of the death of the fœtus,2 and of the absorption of poisonous matter from the uterus. They have been already referred to, and need not be repeated.

Diagnosis.—The diagnosis of missed labour is made from the history of the case,1 the symptoms to which the death of the fœtus gives rise,3 and the results of a careful examination of the patient. Missed labour has to be distinguished from the retention of a dead full-term fœtus in the sac of an extra-uterine pregnancy. In either case, the symptoms and history are very much the same, but by a careful examination it will be possible to determine that in the case of a missed labour the fœtus is retained in the uterus, while in the case of an extra-uterine pregnancy the uterus is empty. It may be difficult to map out the uterus as a separate tumour in a case of extra-uterine pregnancy, but the passage of the sound will enable us to ascertain its position and contents, or, if necessary, the cervix may be dilated with tents and the cavity explored with the finger. As the fœtus is obviously dead, and full term passed, there is no contra-indication to either of these proceedings.

Treatment.—The treatment consists in dilating the cervix and removing the fœtus. The cervix may be dilated at first with tents, and then further dilatation obtained by the use of Frömmer's or of Barnes' dilators. In some cases, the dilatation of the cervix may bring on uterine contractions, and the fœtus be expelled. If contractions do not occur, the fœtus is extracted by traction on the leg, podalic version being first performed if necessary. If the case is one of long standing, and the fœtus is completely disorganised, the cervix must be dilated as far as possible, and the remains of the fœtus removed by the hand passed into the uterus.

CHAPTER VIII

EXTRA-UTERINE PREGNANCY

Varieties—Course of Pregnancy—Ætiology—Pathological Anatomy, Changes in the Tube, in the Ovum, in the Uterus—Interstitial Pregnancy—Isthmial Pregnancy—Ampullar Pregnancy—Tubal Abortion—Symptoms—Diagnosis—Treatment, before Rupture of Gestation Sac, at the time of Rupture, after Rupture.

EXTRA-UTERINE pregnancy is the term applied to the implantation and growth of the fertilised ovum outside the uterus. This condition is also known as ectopic gestation.

Varieties.—The primary varieties of extra-uterine pregnancy are classified according to the site on which the ovum becomes implanted. In almost all cases it is implanted on the mucous membrane of the Fallopian tube, and to this variety the term tubal pregnancy is accordingly applied. The fertilised ovum may also be implanted on the ovary, or perhaps it would be more correct to say that the unfertilised ovum may become impregnated in the Graafian follicle. To this variety the term ovarian pregnancy is applied, and though its occurrence has been for long disputed, at least five cases* have been recorded which are regarded by most writers as definitely establishing the fact that such a condition has occurred. It is also considered by some observers that the ovum may be implanted on the peritoneum, and to this condition the term abdominal pregnancy is applied. The possibility of such a condition is, however, very doubtful, and is altogether denied by most observers, in spite of the fact that a case which appears to have no other possible explanation has been recorded by Galabin.† The difficulty in the way of accepting the possibility of abdominal pregnancy is that of accounting for a process by which the ovum can under any circumstances become attached to the peritoneum. Webster‡ considers that primary intra-peritoneal pregnancy is improbable, because the peritoneal tissues cannot, as far as is known, undergo the changes required for the establishment of the necessary relation with the young ovum. He, however, considers ovarian pregnancy to be just as improbable for a similar reason.

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* Tussenbroeck (*Annales de Gyn.*, 1899, liii. 537). Anning and Littlewood (*Trans. Obstet. Soc. Lond.*, 1901, xliii.). Thompson (*American Gynæcology*, 1902, i. 1-15). Gottschalk (*Centralb. f. Gyn.*, 1886, 727). Franz (*Hegar's Beiträge zur Geb. und Gyn.*, 1902, vi. 70)

† *Trans. Obstet. Soc. Lond.*, 1896.

‡ 'Ectopic Pregnancy,' p. 14.

The possibility of the occurrence of either ovarian or abdominal pregnancy is an interesting point which will doubtless be cleared up in the future. However, practically, the question is not of any great importance. Even if such pregnancies are possible they are excessively rare, and when they do occur they differ in no way, so far as treatment is concerned, from the common form of extra-uterine pregnancy, viz., tubal pregnancy. We may then consider that, for practical purposes, all cases of extra-uterine pregnancy are tubal in origin.

The ovum may develop in one of three portions of the tube. It may develop in the portion which traverses the uterine wall, and in such a case we speak of an interstitial pregnancy. It may develop in the ampullar portion—an ampullar pregnancy. Lastly, it may develop in the intermediate or isthmial portion—an isthmial pregnancy. As will be seen, the course of events is affected to a considerable extent by the part of the tube in which the ovum develops.

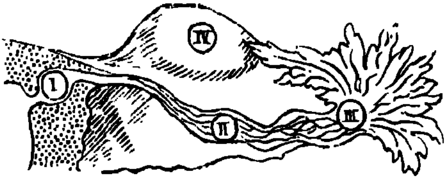

Fig. 288. Diagram of Tube and Ovary, showing the Different Positions in which the Ovum can become Implanted.
(I) Interstitial; (II) isthmial, (III) ampullar, (IV) ovarian.

A condition, which is really an intra-uterine pregnancy, may be included in the following chapter, inasmuch as its symptoms, history, and treatment are identical with those of tubal pregnancy. This is pregnancy occurring in a rudimentary horn of a bi-cornuate uterus. Such a horn is to all intents an abnormally related Fallopian tube, and when pregnancy occurs in it, there is frequently the greatest difficulty in distinguishing between it and a gravid Fallopian tube, even when the abdomen has been opened and the parts are visible.

Course of Pregnancy.—It will, perhaps, assist the student in understanding this subject if we commence by briefly describing the usual course of events which occur in a tubal pregnancy. The impregnated ovum lodges in one of the three sections of the tube, and grows there. If it lodges in the interstitial section, the growing tube encroaches on the uterine cavity; if in the isthmus, the tube separates the folds of the broad ligament:

and if in the ampulla, the ovum may protrude through the abdominal ostium of the tube. At some date, usually between the sixth and the twelfth week, the tube has reached the maximum degree of distension that it is capable of, and, in consequence of the further growth of the ovum, it ruptures. In the case of an interstitial pregnancy, this rupture may take place in one of three directions:—Into the uterine cavity, into the peritoneal cavity, or between the separated layers of the broad ligament. In an isthmial pregnancy, rupture may take place in one of two directions:—Into the peritoneal cavity, or between the separated layers of the broad ligament. In an ampullar pregnancy, rupture can occur only into the peritoneal cavity, but another termination is in this case also possible—*i.e.*, the expulsion of the ovum through the dilated ostium of the tube into the peritoneal cavity without any rupture occurring—the so-called tubal abortion. Rupture of the tube has two important consequences—the occurrence of hæmorrhage, and the partial or complete detachment of the ovum. 1 If the tube ruptures into the uterine cavity, the case will in all probability be mistaken for an abortion, and will present the same symptoms. 2 If the tube ruptures into the abdominal cavity, or if the ovum is expelled into the cavity, more or less profuse intra-peritoneal hæmorrhage occurs. a If the escaped blood becomes encysted in Douglas's pouch, the condition is spoken of as a retro-uterine hæmatocele. If the blood does not become encysted, the condition is spoken of as diffuse intra-peritoneal hæmorrhage. 3 If the tube ruptures into the layers of the broad ligament, the hæmorrhage is extra-peritoneal. a If the escaped blood does not travel beyond the broad ligament, the condition is termed a hæmatoma of the broad ligament. b If, on the other hand, it burrows its way through the sub-peritoneal connective tissue, a diffuse sub-peritoneal hæmorrhage results. Finally, if the blood becomes encysted either intra- or extra-peritoneally, the amount lost will not be very great, or, at any rate, will not be sufficient to cause the death of the patient. If, on the other hand, the hæmorrhage is diffuse, the life of the patient will almost certainly be lost unless the hæmorrhage is checked.

The second important consequence of rupture is the effect it produces on the position of the ovum. a If the ovum is completely detached when the tube ruptures, it almost certainly dies; b if, on the contrary, a sufficient portion of it remains attached to furnish the embryo with the necessary amount of oxygen and nutriment, the fœtus may live and the ovum continue to grow. In such cases, the subsequent history very largely depends upon the site of the original rupture. / In an interstitial pregnancy that ruptures into the uterus, it is conceivable that the ovum may not be detached and that pregnancy may continue, the ovum growing out into the uterine cavity, and the case practically passing into an intra-uterine pregnancy. 2 If the tube ruptures into the peritoneal cavity, and the ovum continues to live, the primary tubal pregnancy is gradually altered into what is known as a secondary abdominal pregnancy. The ovum gradually extends into the abdominal cavity, and the placenta spreads beyond the limits of the tube until it covers part of the pelvic or parietal peritoneum, the peritoneal surface of the uterus, or of the intestines. If, on the other hand, the tube ruptures between the layers of the broad ligament, and the ovum survives that event, the latter gradually extends into the layers of the broad ligament, and the primary tubal pregnancy is altered in this case into a secondary broad ligamentous pregnancy, or mesometric pregnancy, as it is sometimes termed.

If a secondary abdominal pregnancy results, the remainder of the course of pregnancy may be comparatively uneventful. If, however, a broad ligamentous pregnancy results, the course of pregnancy is usually interrupted by a second rupture of the gestation sac. In a broad ligamentous pregnancy, the ovum grows between the layers of the broad ligament, which is pushed upwards and outwards. As the peritoneum is very elastic, it stands this distension for some time, but in some cases it finally becomes over distended, as in the case of the tube, and ruptures. The consequences of this largely depend upon the situation of the placenta. If, as is perhaps most frequently the case, the placenta is situated above the ovum—that is, towards the top of the broad ligament, it will probably be involved in the rupture, and the most serious hæmorrhage will result, almost certainly leading to the death of the patient. If, however, it is situated beneath the ovum, rupture of the thinned-out upper layers of the broad ligament can occur without involving it, and consequently without causing a necessarily fatal hæmorrhage. In such a case, the broad ligamentous pregnancy becomes converted into an abdominal pregnancy.

In cases in which the ovum survives the rupture of the gestation sac, there are no further special symptoms until full term is reached. Then, a form of false labour may be set up, the uterus expels a decidual cast of its cavity, and the fœtus dies. If the dead fœtus is allowed to remain in the abdominal cavity, putrefaction, or the formation of a lithopædion may result. If putrefaction occurs, an abscess will result and burst into some of the hollow viscera or through the parietes. Such an abscess may continue to discharge for years, if the patient lives, and during that period fragments of the fœtus will come away piecemeal. In cases in which putrefaction and suppuration have not occurred, women have been known to carry about the remains of a full-term fœtus for upwards of forty years.

This brief outline of the course of tubal pregnancy will enable the student to understand more clearly the symptoms and physical signs of the three periods into which we shall divide tubal pregnancy, as well as the reasons for so dividing it. These periods are:—From the commencement of pregnancy to the occurrence of rupture; at the time of rupture; and from the occurrence of rupture to the removal of the ovum. It will be seen here that we have alluded to but one period of rupture. This is, however, clinically sufficient. Secondary rupture only occurs in a certain proportion of cases, and in these cases the symptoms of primary rupture have been little if at all marked. The reasons for this are obvious. In the first place, when the ovum is expelled between the layers of the broad ligament there is usually little hæmorrhage. In the second place, if there was sufficient hæmorrhage to cause serious symptoms, the death of the ovum would almost certainly occur, and consequently there would be no ovum to cause a secondary rupture. Accordingly, although actually in these cases there are two ruptures—one of the tube, and the other of the investing broad ligament, clinically our attention is drawn to one or other alone, for the reasons given.

Ætiology.—The question, What causes an extra-uterine pregnancy? is closely connected with another equally important question, Where is the normal site of fertilisation of the ovum? It is obvious that until the latter question is satisfactorily answered only vague surmises can be given as an answer to the former. The various views regarding the normal site of fertilisation may be reduced to three:—That the ovum is always fertilised in the uterine cavity; that the ovum is always fertilised in the tube; and that it may be fertilised at any point on its route between the ovary and the uterus, or in the uterus itself.

The first of these views was advocated strongly by Lawson Tait,* who considered that 'the uterus alone is the seat of normal conception, and that the function of the ciliated lining of the Fallopian tube is to prevent spermatozoa from entering the tube.' Bland-Sutton† also supports this view, and states that when fertilisation 'occurs in the tubes it is accidental, and tubal gestation is the consequence.' In accordance with this view, Tait looked for the cause of extra-uterine pregnancy in any condition which destroyed the ciliated epithelium. Bland-Sutton does not apparently commit himself in the article quoted to any definite statement of cause, but considers that, wherever the ovum is fertilised, it engrafts itself on the adjacent mucous membrane whether tubal or uterine. Tait's notion regarding the action of the ciliæ had some support when it was believed that the ciliæ of the uterus and of the tubes acted in opposite directions, the uterine ciliæ moving towards the fundus, the tubal ciliæ from the abdominal to the uterine ostium. Under such circumstances, it was not unnatural to believe that the function of these opposing movements was to bring the ovum and spermatozoon together in the uterine cavity. Hofmeier,‡ however, has proved that the direction of the movements of the ciliæ is downwards in both uterus and tube, that is from the abdominal ostium to the cervix, and that, consequently, there is no natural mechanism of this kind to promote a union in the uterus. Moreover, Dührssen* has found spermatozoa not only in the Fallopian tubes after extirpation, but also in the abdominal ostium, in cases where there was no tubal disease. It is difficult then to believe that the uterus is the sole normal site of fertilisation of the ovum.

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* 'Lectures on Ectopic Gestation and Pelvic Hæmatocele,' Birmingham, 1888, p 107.

† 'Extra-Uterine Pregnancy,' Allbutt and Playfair's 'System of Gynæcology,' p. 451.

‡ *Centralb. f. Gyn.*, 1893, No. 33, 764-766.

The second view that the ovum is always fertilised in the Fallopian tube is strongly held by Strassmann, with the support of Bischoff and His, who consider that 'fructification takes place in the Fallopian tube probably at the fimbriated end, and immediately after the exit of the ovum from the follicle. If this is so, every pregnancy begins as an extra-uterine one, and the fact that it remains extra-uterine will probably be due to a retarded movement of the fructified ovum.'† This view is difficult to disprove and impossible to prove. It is unquestionable that, when the normal unfertilised ovum is set free from the Graafian follicle, it traverses the tube, passes into the uterus, and is thence expelled. If the tube is the only normal site of fertilisation, then coitus, to result in impregnation, must take place before the ovum has passed into the uterine cavity. Consequently, either the ovum must take a considerable time in passing through the tube, or else fertilisation can only take place within a very short period after ovulation. It is, however, to say the least of it, improbable that the ovum takes a long time to pass through the tube, as it cannot subsist on its yelk for more than a short time; while, if it passes through rapidly, the available time during which a fertilising coitus can take place must be equally short. It would then appear that the third view which we have mentioned is the most probable, and that fertilisation can take place at any point between the ovary and the uterine cavity, or in the latter. In view of the many curious and unexplained phenomena with which the process of fertilisation is surrounded, it is not very difficult to consider that there is a natural attraction between the ovum and the spermatozoon, which tends to bring them together. If the spermatozoon meets the ovum in the uterus, fertilisation occurs there. If the spermatozoon reaches the uterus before the ovum, the same tendency will draw it into the tube to meet the ovum. If the ovum has not as yet entered the tube, the spermatozoon may reach the fimbriated extremity, or even pass into the peritoneal cavity. The fertilised ovum will then, under normal circumstances, continue its course to the uterus, where it becomes embedded.

If, then, we accept the view that, under normal circumstances, the spermatozoa may find their way into the Fallopian tubes, we have next to determine, so far as possible, the factors which cause the fertilised ovum to remain in the tube instead of descending into the uterus. These factors are probably to be found in conditions which, while offering no obstruction to the ascent of the spermatozoon, prevent the descent of the fertilised ovum. Such conditions are [1] inflammatory hyperplasia or hypertrophy of the tubal mucous membrane; [2] diverticula of the tube; [3] exaggerated convolutions; accessory fimbriated extremities; cicatricial contractions or obstruction by bands of adhesions or from the pressure of tumours or neighbouring organs; [6] and the presence of intra-tubal tumours. An interesting case in which the last-named condition was probably the cause of a tubal pregnancy is recorded by Dührssen.* In it, a small polypus appeared to have formed a very perfect ball-valve, which allowed bodies to pass from the uterus to the ovary, but prevented them from passing in an opposite direction. The pregnancy was found at the ovarian side of this obstruction. In a case operated on by Smyly, a small accessory fimbriated extremity was present (v. Fig. 289).

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* *Archiv f. Gynäk.*, Band liv., Heft 2,297.

† 'Beiträge zur Lehre von der Ovulation,' etc., *Archiv f. Gynäk.*, 1896.

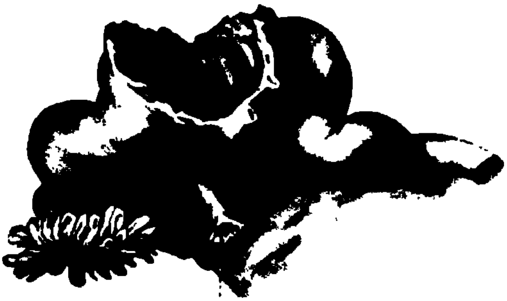

FIG. 289.—A RUPTURED FALLOPIAN TUBE.
O, An accessory abdominal ostium.
(From a specimen removed by operation by Dr W. J. Smyly.)

Some observers, and notably Webster, while admitting the part played in the causation of tubal pregnancy by obstruction to the descent of the fertilised ovum, consider that another factor is also necessary. This factor Webster considers is to be found in some developmental fault in the tubal mucous membrane which permits it to respond to what he terms 'genetic influence,' that is to say, to take its part in the formation of a decidua as does the mucous membrane of the uterus. If this power of response is wanting, the ovum may become retained in the tube, but it will not be able to take root there and grow. Given, however, 'the fertilisation of the ovum high in the tube, the obstruction to its free passage to the uterus after this takes place, along with the occurrence of the necessary decidual reaction in the mucosa with which the ovum comes in contact, and we have a satisfactory explanation of the pregnancy which develops.'* This view is very plausible so far as tubal pregnancies are concerned. The occurrence of an ovarian or primary abdominal pregnancy would, however, seem to show that such a power of response to genetic influence was not necessary.

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* 'Ueber Operative Behandlung,' *Archiv f. Gynäk.*, Band liv., Heft 2, 1897

We may sum up the views on the ætiology of tubal pregnancy which appear to us to be the most probable, in the words of Taylor,† whose conclusions appear to be probably as nearly correct as any can hope to be in the present state of our knowledge:—

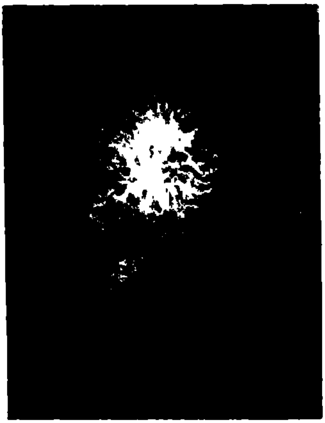

FIG. 290.—THE OVUM WHICH ESCAPED FROM THE RUPTURED TUBE SHOWN IN FIG. 289.

Note the massing of the villi at one pole of the ovum.

(1) Normal impregnation of the ovum is not limited to the uterus, but may occur anywhere in the Fallopian tube or immediately on the exit of the ovum from the ovary.

(2) Normal attachment and development of the ovum is limited to the uterus.

(3) Abnormal arrest of the impregnated ovum, whether mechanical or special, in its progress towards the uterus is the determining factor of a misplaced pregnancy. An extra-uterine pregnancy is, therefore, the result of the permanent arrest of a fructified ovum in its passage from the ovary to the uterus.

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* *Op. cit.*, p. 13.

† 'Extra-Uterine Pregnancy,' *Brit. Gyn. Jour.*, May, 1898, p. 89. We desire also to acknowledge our indebtedness to Mr. Taylor's article for many references and for much information on the present subject.

Pathological Anatomy.—**Changes in the Tube.**—The changes which take place in the tube depend to a considerable extent upon the exact site of implantation of the ovum. The following changes, however, may be considered as common to the different sites. The tube increases in size to suit the growing ovum. At first, its muscular fibres hypertrophy, but, later—from the third month on—they are apparently unable to hypertrophy further, and as the ovum grows the bundles of muscle fibre become widely separated, and atrophy. In the rare instances in which the ovum has been found at an advanced stage of pregnancy in an unruptured tube, there is no appearance of muscle fibre in the tube wall save in a few isolated areas. The bloodvessels of the tube are somewhat increased in size, and, subsequently, if the fœtus continues to develop, reach very considerable dimensions in order to bring the necessary supply of blood to the placenta. In some cases, the abdominal ostium is closed by a curious mechanism. The hyperæmia of the parts leads to a turgescence of the peritoneum and muscular coat. This turgescence causes these structures to form an irregular ring round the base of the fimbriæ, at about the end of the fourth week. A little later, in consequence of the increased hyperæmia, the swollen peritoneum projects like a sleeve beyond the fimbriæ, and the latter are turned inwards into the lumen of the tube. Finally, the edges of this sleeve gradually come into contact with one another and adhere, so completely closing the ostium. In such a case, the distal end of the tube as seen from without will appear as a blunt rounded stump. If, however, the tube is opened, the fimbriæ will all be found tucked away inside. This process most usually occurs in the case of an ampullar pregnancy, and, when the ovum is implanted in the inner two-thirds of the tube, it is not so common. In some cases, quite the opposite condition of the ostium is found, and the latter is represented by an annular opening, measuring perhaps nearly an inch in diameter. This is usually the case when the ovum is implanted in the infundibulum of the tube, and projects through the ostium as it grows, causing the so-called tubo-ovarian or tubo-peritoneal pregnancy.

It is most probable—if not certain—that, in all cases, a decidua vera is formed in the tube. As in the case of the uterine decidua, the vera consists of a superficial compact layer and a deep spongy layer. The existence of a decidua reflexa in all cases is more doubtful. The relation between the size of the ovum and that of the lumen of the tube is altogether different from the relation between the size of the ovum and that of the uterine cavity (Webster*), and, consequently, the decidua vera may soon come into contact all round with the ovum, and thus render the formation of a distinct reflexa impossible. If, on the other hand, the tubal lumen is large, and the ovum is only attached to one portion of its wall, a more or less complete decidua may be formed.

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* *Op. cit.*, p. 130.

Changes in the Ovum.—The ovum develops in the tube in a similar manner to that in which it develops in the uterus save that it is more liable to be interfered with by traumatisms. It not *infrequently happens that the death of the fœtus* is caused by repeated intra-tubal hæmorrhages, or by hæmorrhage into the sub-chorionic chamber, *i.e.*, the space between the chorion and the amnion. These hæmorrhages are gradual and recurrent, and result in the formation of a laminated clot, which invests the entire ovum or the amniotic sac, as the case may be. To this condition the term tubal mole is applied. Bland-Sutton, who has studied these moles, considers that the blood is usually limited externally by the chorion and internally by the amnion, and that it is derived from the circulation of the embryo, while any blood which invests the ovum externally comes from the maternal circulation. The main proof which he offers of the former statement is that the blood-cells found in the clot are nucleated. It must, however, be difficult to determine whether a blood-cell in a clot is nucleated or not, and we find an insuperable difficulty in explaining how an embryo a few weeks old can supply an amount of blood which must be from three to six times its own volume. It would certainly seem that, although the embryo may contribute a few nucleated blood corpuscles, the large proportion of the blood must come from the maternal circulation.

The consequences of the formation of a mole are, as in the case of a uterine pregnancy, recurrent hæmorrhages. If the ostia of the tube are occluded, this results in the increase in size of the mole, and the ultimate rupture of the tube. If, on the other hand, the abdominal ostium is patent, the blood is expelled into the abdominal cavity, where it forms a mass surrounding and adherent to the fimbriated extremity of the tube. In some cases, the blood coagulates in the tube, and is then expelled through the ostium by the pressure of further hæmorrhage as a long sausage-shaped mass, which has been found coiled up in Douglas's pouch (Noble). The history of tubal rupture, the result of mole formation, is identical with rupture the result of a living ovum, save that in the former case there is no living ovum to continue to grow. When a mole forms in the case of an ovum situated in the infundibulum of the tube, it is often expelled partially or completely into the peritoneal cavity. To this process, the term *tubal abortion* has been given.

The changes which take place in the ovum in which the fœtus dies, but no tubal mole is formed, have been already briefly alluded to. Probably, up to the end of the third month, the most common termination is its complete, or almost complete, absorption. After this period, the fœtus and placenta have reached too great a size to be completely absorbed, and one or other of the changes which have been already mentioned occur. If the ovum is infected by bacteria from the intestines, it decomposes and an abscess results. If this abscess is limited to Douglas's pouch, it will follow the same course as does a suppurating hæmatocele. If, however, pregnancy was further advanced, the abscess may form anywhere in the abdominal cavity according to the position in which the fœtus lay. Such abscesses may reach a considerable size, and, finally, burst into one of the hollow viscera or vagina, or through the abdominal wall. They may then continue to discharge for years, until either the patient succumbs to the long-continued suppuration, or the remains of the ovum are completely expelled. In 248 cases collected by Webster, the abscess burst into the intestinal canal in 55 per cent. of cases; through the abdominal wall in 23 per cent.; into the vagina in 12 per cent.; and into the bladder in 10 per cent.

The other changes which may take place in the fœtus are mummification, conversion into adipocere, and calcification. The last-named change may affect the membranes alone, or may also affect the fœtus, a thick, compact, but fragile crust forming over the latter, 'as if the vernix caseosa had been altered' (Webster).

The changes, which take place in the relations of the placenta and membranes to the surrounding parts after the rupture of the tube or the secondary gestation sac, will be referred to a little later.

It was formerly considered by many observers that the placenta continued to grow after the death of the fœtus. This opinion was apparently based on the fact that in many cases the placenta increased in size. This increase has, however, been found to be due, not to any further growth in its essential elements, but to extravasations of maternal blood into its substance. These hæmorrhages may be slight, or they may be so considerable as to alter the placenta from a thin discoid mass to a comparatively thick or almost oval body. Subsequently, these extravasations are converted into masses of fibrin, the villi degenerate, and finally the mass becomes organised into fibrous tissue of a low type into which the maternal vessels extend (Webster).

Changes in the Uterus.—The uterus invariably increases in size *pari passu* with the growth of the ovum in the tube. It never, however, attains the same size as would be the case if the pregnancy was intra-uterine. Its shape remains that of the non-impregnated uterus, and does not assume the globular outline characteristic of pregnancy during the first four months. The uterus in the case of an extra-uterine pregnancy is usually, during the first four months, from a third to a fourth smaller than a pregnant uterus of the same date. After that, it may still increase in size, but the increase is less rapid. At term, it has been found to measure from four to seven and a half inches in length. Many of the other changes characteristic of pregnancy may occur to a slight extent, but are not so marked as in uterine pregnancy.

The body is softer than in the non-impregnated state, and so is the cervix. The cervical canal may be slightly patulous, and contain a plug of mucus. Apparent shortening of the cervix may be noticeable. The position of the uterus is altered according to the position and size of the extra-uterine pregnancy.

Next to the increase in size of the organ, the most important change is the formation of a decidua. This decidua resembles closely the decidua vera in a case of uterine pregnancy, lines the entire cavity, and varies in thickness from 6 to 10 millimetres. When expelled in one piece it is triangular in shape, the base of the triangle corresponding to the fundus, and the angles at the base to the openings of the Fallopian tubes. The uterine aspect is shaggy and rough, the free aspect smooth. Microscopically, the connective-tissue cells of the endometrium have been converted into decidual cells, the superficial portions of the glands have been compressed and partially obliterated, while the capillaries are dilated. Some observers consider that the nearer the extra-uterine pregnancy is situated to the uterus, the more marked is the decidual formation. The decidua may be expelled from the uterus at any time during the progress of an extra-uterine pregnancy. Expulsion, however, is particularly likely to occur at the time of rupture of the tube, or at full term if the ovum lives to that time. The decidua may be expelled in a single mass, and form a cast of the interior of the uterus, as has been described, or it may be expelled piecemeal at different times. If it is not expelled in either of these ways, it may undergo atrophy, degeneration, and absorption, as in the case of the decidua of an intra-uterine pregnancy.

At full term, a form of spurious labour occurs. The uterus contracts, the cervical canal dilates to a variable extent, and the decidua is expelled, if its expulsion has not already occurred. There is an accompanying hæmorrhage, and the contractions may give rise to considerable pain. It is impossible at present to state what may be the cause of these contractions. The fœtus usually dies at or about the same time, but its death does not necessarily precede the occurrence of contractions. It has been suggested that the changes in the decidua have become so marked that the latter is to all intents and purposes a foreign body, and so stimulates the uterus to contract (Hennig). In some cases, however, the decidua has been already expelled. It is probable that in all cases of pregnancy—intra- or extra-uterine—the occurrence of labour, true or false, is governed by a law which allows to pregnancy a certain period, or cycle. There is a cardiac cycle, a respiratory cycle, a menstrual cycle, and probably a gestation cycle, the periodicities of which are governed by laws of which nothing is known. In the case of the gestation cycle, these laws probably act whether the pregnancy is in the uterus or outside it, and the objective sign that they have commenced to act is furnished by the occurrence of uterine contractions.

A few words must now be said on the subject of each form of tubal pregnancy.

E. INTERSTITIAL PREGNANCY.

An interstitial or tubo-uterine pregnancy is the rarest form of extra-uterine pregnancy. In this condition, the gestation sac is embedded in the uterine wall, and causes marked asymmetry of that organ. As the ovum grows, the wall of the sac becomes thinned out, especially in its upper portion, and the muscle fibres in great part disappear, as is shown by a case recorded by Webster,* in which the thinnest part of the wall was only the one-thirty-second part of an inch in thickness, and contained only a trace of muscle fibre. Rupture usually occurs somewhat later than is the rule in ampullar or isthmial pregnancies, in consequence of the thicker walls of the sac, but in almost every case it occurs before the fifth month. Cases have, however, been recorded in which the pregnancy went on to full term without rupture. Rupture may occur into the peritoneal cavity, into the uterine cavity, or into both cavities. The first of these is the most common. 2 Rupture into the peritoneal cavity in these cases is a most serious accident, and is even worse than in the other tubal forms, due in part to the later period of pregnancy at which the rupture usually occurs, and in part to the involvement of the larger vessels of the uterine wall. In 26 cases collected by Hecker,† the death of the mother occurred in every one. Rupture usually occurs at the upper portion of the sac, which, as has been mentioned, is the thinnest part. 3 Rupture into the uterine cavity may not be so serious. Its occurrence tends to prove that the outer wall of the sac is comparatively thick, and, consequently, if the ovum is entirely expelled into the uterine cavity, contraction of the muscle fibres remaining in the wall may be sufficient to check the hæmorrhage. It is possible that in rare cases the uterine end of the tube may dilate, and the ovum be expelled through it. Double rupture of the sac into both the peritoneal and uterine cavities is very rare. In such cases, the fœtus may be expelled through one rent, and the placenta through the other (Webster).

ISTHMIAL PREGNANCY.

In an isthmial pregnancy, the ovum becomes implanted, and develops, in the middle third of the tube. As the ovum grows, the tube wall thins, and the peritoneal folds which form the broad ligament are separated from one another. In almost every case, rupture occurs before the end of the third month, and usually between the sixth and tenth week, but a few cases have been recorded in which pregnancy went to full term without an apparent rupture of the tube occurring. When rupture occurs, the tear may be so situated that the ovum escapes into the peritoneal cavity or between the layers of the broad ligament. Usually, the rent is not very large, and the ovum gradually works its way through it. In other cases, however, it may be of sufficient size to allow the immediate passage of the ovum. The consequences of intra-peritoneal rupture will be discussed in the sections on ampullar pregnancy, as it is of more common occurrence in this condition, and as its symptoms are identical in whatever part of the tube the ovum is situated.

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* *Op. cit.*, p. 77.

† 'Beiträge z. Lehre von d Schwangerschaft,' etc., *Monats. f. Geburts.*, 1859, vol. xiii.

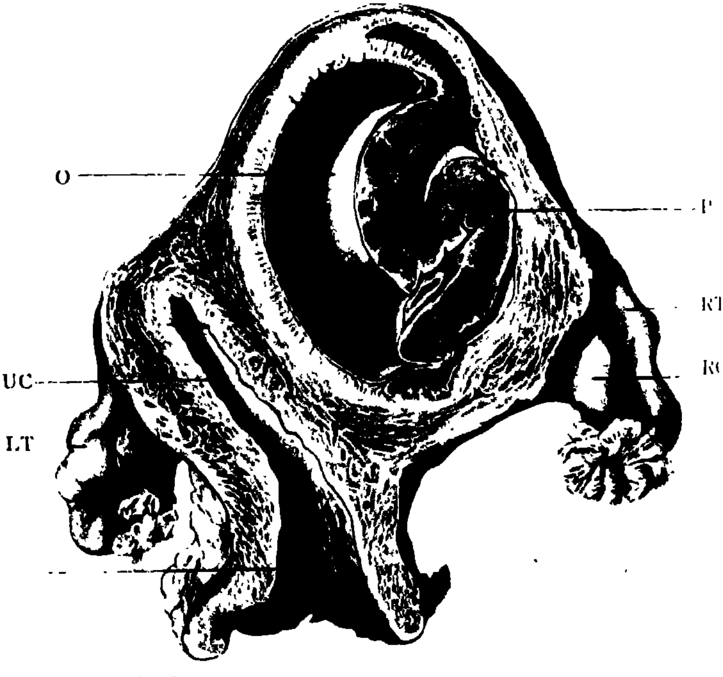

FIG. 291.—AN INTERSTITIAL PREGNANCY AT ABOUT THE FOURTH MONTH
O, Cavity of the ovum. P, placenta; RT, right tube; RO, right ovary. LT, left tube; UC, uterine cavity, C, cervix. (Bumm).

Extra-peritoneal Rupture.—The occurrence of extra-peritoneal rupture of the tube, that is, rupture between the layers of the broad ligament, is practically confined to cases of isthmial pregnancy. [1]In such a case, the ovum may be already dead—a mole having formed;[2]the attachments of the ovum to the tube may be broken down at the time of rupture, and the ovum may die;[3]or, the attachments may not be interfered with, and the ovum may live.[4]Further, the hæmorrhage which accompanies rupture may be checked by the pressure of the peritoneal folds of the broad ligament, and so may be comparatively slight in amount, or the hæmorrhage may burrow under the peritoneum of the pelvic floor and spread through the pelvic connective tissue.

When the ovum is either already dead or dies at the time of rupture, and the hæmorrhage does not extend beyond the broad ligament, the resulting condition is known as a hæmatoma of the broad ligament. In this condition, the blood coagulates and forms a firm tumour, which, if of large size, pushes the uterus to the opposite side, or bulges backwards into Douglas's pouch and pushes the uterus forwards as in the case of a hæmatocele. As a rule, the coagulated blood is gradually absorbed aseptically, without further trouble. Occasionally, however, bacteria may find their way into the hæmatoma from the intestines and set up decomposition or pus-formation. The resulting abscess will then behave in a manner similar to a suppurating hæmatocele.

In the rare cases in which the escaping blood burrows beyond the broad ligament, it may make its way beneath the peritoneum of Douglas's pouch, and extend round the rectum, or bladder, or downwards beside the vagina It may also extend upwards beneath the peritoneum of the anterior abdominal wall, or along the psoas and iliacus muscles. In such cases, the amount of blood lost may be so great as to cause the death of the patient.

The most important termination of extra-peritoneal rupture consists in the gradual passage of the living ovum between the layers of the broad ligament. To this condition, the term secondary broad ligamentous or meso-metric pregnancy is applied. As the ovum passes through the rent in the tube, it comes to lie in a sac formed above by the dilated tube, and laterally by the peritoneal layers of the broad ligament. As the ovum grows, the relations of the peritoneum to the pelvic floor and to the walls of the abdominal cavity become altered. At first, the peritoneum of the broad ligament is pushed upwards, and separated laterally as far as its amount and elasticity permit. Then, in order to allow further increase in size, the peritoneum of the floor of the pelvis is stripped off and included in the covering of the tumour. Finally, this stripping extends to the anterior and posterior pelvic walls, and then to the abdominal walls. In a case recorded by Berry Hart, in which the patient died undelivered at full term, the peritoneum was stripped off the anterior abdominal wall for a distance of 7¾ inches above the pelvic brim, and posteriorly up to the level of the junction of the fourth and fifth sacral vertebræ. This stripping of the peritoneum is a point of considerable importance from an operative point of view, as will be subsequently seen. The degree to which it occurs probably depends on the natural strength of the peritoneum, and on the strength of its attachments to the sub-peritoneal tissues.

In the majority of cases, either the former is too weak or the latter too strong to allow the peritoneum to stand the strain which the growing ovum places on it, the necessary degree of stripping does not occur, and, consequently, secondary rupture of the gestation sac occurs about the middle of pregnancy. The consequence of this rupture will almost certainly be the death of the patient from hæmorrhage, unless immediate operation is undertaken. In some cases, however, the necessary degree of stripping occurs, and the pregnancy advances to term without secondary rupture occurring.

Berry Hart* has rendered great service by pointing out the importance of the relation of the placenta to the displaced ovum in these cases. If the placenta, or in the early months of pregnancy that part of the chorionic villi from which the placenta will subsequently be formed, is situated above the ovum, the extra-peritoneal rupture of the tube will not affect it, and consequently the ovum has the best immediate chance of living. The remote consequences are, however, very much more serious both for the fœtus and the mother than they are in cases in which the placenta is situated below the ovum. When the placenta is above the fœtus, the latter burrows downwards between the layers of the broad ligament until it has occupied all the available space. Then, it of necessity exerts an upward pressure upon the placenta and the latter is displaced upwards. In such cases, as the placenta grows, it extends over the displaced peritoneum, and perhaps on to the anterior abdominal wall from which the peritoneum has been stripped. During this stage, repeated extravasations of blood occur, and cause a varying degree of destruction of the placental tissue. Later, if secondary rupture of the gestation sac occurs, the tear will involve the placenta, or the large vessels which supply the latter, and the hæmorrhage will be so serious as to prove almost immediately fatal.

When the placenta lies below the fœtus, the latter, as it grows, pushes the placenta downwards against the pelvic floor. Here, it has a firm base of attachment, and can extend on to the surrounding structures without risk of subsequent displacement. Further, even if secondary rupture of the sac occurs, the consequences are not so serious owing to the non-involvement of the placental vessels.

Secondary rupture of a broad ligamentous pregnancy may occur at any time from the twelfth week onwards, and perhaps most usually occurs about the fifth month. The rupture is said to be most usually situated in the posterior-superior portion of the sac wall (Werth). If the placenta lies above the fœtus, the rupture is almost certainly fatal, owing to violent hæmorrhage. If the placenta is below the fœtus, the hæmorrhage may be slight, and afford time for operation; or, if the rupture occurs gradually in a non-vascular portion of the sac, the ovum may slowly pass through it into the peritoneal cavity as in some cases of primary intra-peritoneal rupture of the tube. In such an event, the subsequent history of the case is identical with that of primary intra-peritoneal rupture in which the ovum survives, and will be discussed later.

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* *Edin. Med. Journ.*, vol. xxxiii., p. 322.

In those cases in which secondary rupture does not occur, the fœtus dies at full term, and one or other of the various changes to which we have already referred, occurs in the ovum.

G AMPULLAR PREGNANCY.

In an ampullar pregnancy, the ovum becomes implanted in the outer third of the tube. If it is situated close to the abdominal ostium, the condition is further specified as an infundibular pregnancy. As the ovum grows, the tube distends, but, inasmuch as the ampulla is almost completely invested by peritoneum, there is no tendency for the peritoneal layers of the broad ligament to be forced apart. Consequently, when rupture occurs the ovum always escapes into the peritoneal cavity.

There are three possible terminations of a case of ampullar pregnancy. First, and most commonly, intra-peritoneal rupture may occur. Secondly, and also fairly commonly, tubal abortion may occur and the ovum be expelled in part or altogether through the abdominal ostium into the peritoneal cavity. Lastly, and very rarely, the tube may dilate sufficiently to enable it to accommodate the ovum up to full term without rupturing. The last of these three terminations does not call for any special remark. Clinically, it would probably be difficult to distinguish such a case from one of broad ligamentous pregnancy, as the symptoms and consequences of the two are practically identical. The first two terminations must be discussed separately.

Intra-peritoneal Rupture.—Intra-peritoneal rupture, as we have seen, may be either primary or secondary. Primary rupture occurs when the tube ruptures, and the ovum is expelled directly into the peritoneal cavity. Such a termination may occur in any form of tubal pregnancy—interstitial, isthmial, and ampullar, and, in all, the results so far as the patient and ovum are concerned are similar. Secondary rupture occurs when a broad ligamentous pregnancy—the result of a primary extra-peritoneal rupture of the tube,—in turn ruptures into the peritoneal cavity.

It may be well to repeat that in cases of secondary rupture, the primary extra-peritoneal rupture will most usually—if not always—have escaped notice, as, if the symptoms produced were marked, the death of the ovum would almost certainly have occurred, and consequently there would have been no such thing as a secondary rupture.

The usual time at which intra-peritoneal rupture occurs is from the sixth to the tenth week in the primary form, and during the fourth, fifth, and sixth months in the secondary form. The following table is compiled from a number of statistics collected by Webster*:—

Date of Rupture.	Number of Cases.	Date of Rupture.	Number of Cases
1st month - -	39	7th month - -	1
2nd ,, - -	141	8th ,, - -	6
3rd ,, - -	74	9th ,, - -	1
4th ,, - -	49	10th ,, - -	9
5th ,, - -	8	After 10th month -	1
6th ,, - -	1		
Total number of cases - - 330			

One of three consequences are possible in cases of intraperitoneal rupture. 1 The hæmorrhage may be profuse and be poured out into the general abdominal cavity—diffuse hæmorrhage. 2 the hæmorrhage may be moderate in amount and collected in Douglas's pouch, where it clots and forms a retro-uterine hæmatocele ; 3 the hæmorrhage may be insignificant in amount, and the ovum may continue to develop.

1 Diffuse hæmorrhage is the most serious consequence, and inevitably results in the patient's death within twenty-four hours, unless immediate operation is performed and the bleeding checked. If the abdomen is opened, the peritoneal cavity is found to contain a variable quantity of free blood and clots, and, in many cases, it is possible to find the fœtus or mole which has been expelled from the tube. In cases of secondary rupture, it is always possible to do so on account of the greater size of the ovum. The amount of hæmorrhage which occurs depends upon the age of the pregnancy, and, in secondary ruptures, the relations of the placenta to the gestation sac. In primary rupture, the ovum may be entirely separated and expelled from the tube. In secondary rupture, on the other hand, the placenta may be torn through, but it will still remain in great part adherent to its site.

2 The formation of a retro-uterine hæmatocele is probably a dependent upon the rate at which the hæmorrhage occurs. If it escapes slowly, but is persistent or recurrent, the escaped blood has time to clot round the site of rupture. As fresh hæmorrhage occurs, the clotted blood is pushed outwards away from the rupture, and its place is taken by fresh blood, which in turn clots and is pushed outwards. Finally, the clotted blood in the outer layers becomes too firm to allow any further displacement, and then the hæmorrhage is stopped by the increased pressure in the centre of the mass of clot. 4 In other cases, the formation of a hæmatocele may be brought about by the presence of adhesions which prevent the upward escape of blood and confine it to

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* *Op. cit.*, p. 63.

Douglas's pouch. The same train of events may occur in cases of tubal abortion, as will be presently seen, and is perhaps more common in that condition than in tubal rupture, in consequence of the more gradual manner in which the blood usually escapes. The formation of a hæmatocele is probably confined to cases of primary rupture, and to cases of secondary rupture occurring early in pregnancy. In a hæmatocele, the blood first collects round the opening through which the ovum has been expelled, and then makes its way into Douglas's pouch. If it reaches a large size, it may extend high up into the abdomen. At first, it is soft and boggy in consistency, with a dome-shaped top. It displaces the uterus usually forwards, but sometimes it may drive the latter backwards or surround it completely. At first, a hæmatocele compresses the rectum against the wall of the pelvis, and, later, as the effused blood coagulates and the periphery of the mass

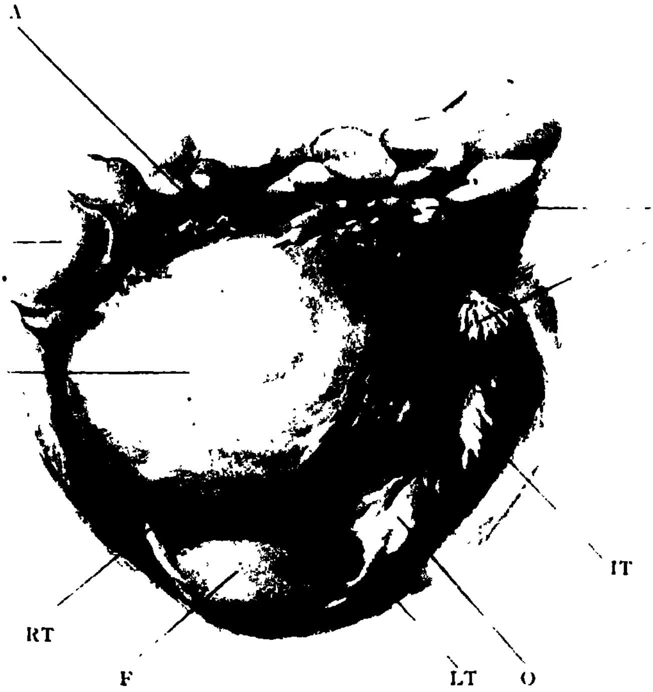

Fig. 292.—A Retro-uterine Hæmatocele formed by the Rupture of a Left-sided Tubal Pregnancy.

U, Fundus uteri; RT, right tube, H, hæmatocele, C, cæcum; A, appendix, S, sigmoid flexure, LT, left tube, IT, isthmus of left tube; F, tubal fimbriæ; O, site of rupture in tube. (Bumm) becomes hard, it surrounds the upper part of the rectum as a firm collar, which often causes a temporary stricture. In the past, it was customary to consider that only a small proportion of cases of hæmatocele were due to extra-uterine pregnancy. This view, however, can no longer be adopted, and, on the contrary, it is almost certain that it is only a very small proportion of cases of hæmatocele which are not so caused.

a In the case of a large hæmatocele, the patient may die in consequence of the loss of blood, but such an occurrence is unusual. b A small or medium-sized hæmatocele is usually absorbed, and may almost completely disappear. c Lastly, any hæmatocele may be infected from the intestines and undergo decomposition and suppuration. If the fœtus is very small, it will probably share the fate of the hæmatocele. If, however, the fœtus is too large for absorption, it will undergo one of the changes which have been already referred to. When suppuration occurs, and an abscess forms, the pus will eventually make its way externally, owing to the abscess bursting, usually into the vagina or rectum, more rarely into the bladder, or intestine, or through the abdominal wall.

3 The third and last consequence of intra-peritoneal rupture is the gradual extension of the ovum into the peritoneal cavity, without interference with its attachments to the gestation sac, and without the occurrence of serious hæmorrhage. a The possibility of the ovum surviving primary intra-peritoneal rupture has been strongly denied by Bland-Sutton[*] and by Tait,[†] mainly on the ground that the amniotic sac is always torn, and that an unprotected embryo in the peritoneal cavity would be quickly absorbed. The second part of this statement is probably true, but cases have been recorded which appear to prove beyond doubt that primary intra-peritoneal rupture of the tube can occur without an accompanying rupture of the amnion, and that in some of such cases the ovum can survive and develop to full term (Taylor,[‡] Webster[§]). d In cases of secondary rupture of a broad ligamentous pregnancy, the fœtus has usually reached such a stage of development that it is able to resist the absorptive properties of the peritoneum, and, consequently, even if it is expelled unprotected into the peritoneal cavity, it may still continue to develop. In cases of primary intra-abdominal rupture in which the ovum survives, the principal attachment of the placenta is usually to a dilated Fallopian tube, and from there it has spread to the neighbouring parts, and so may be adherent to the surface of the uterus, or to parts of the intestines. The relations of the placenta at term in cases of secondary intra-abdominal rupture have been already described. Invariably, in cases in which the ovum has survived the rupture, the placenta lies below the fœtus and has its main attachment to the

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[*] *Op. cit.*

[†] 'Lectures on Ectopic Pregnancy,' p. 59.

[‡] *Op. cit.*

[§] *Op. cit.*

pelvic floor, where it may extend over the anterior or posterior abdominal walls from which the peritoneum has been stripped. The death of the fœtus occurs at or soon after term has been reached, and then one or other of the different changes which have been already referred to take place.

Tubal Abortion.—The second common termination of a case of ampullar pregnancy is the occurrence of tubal abortion (*v.* Fig. 293). This is the most usual ending of those cases in which the ovum is implanted in the infundibulum of the tube—the so-called infundibular or tubo-peritoneal pregnancy, as in such cases the growing ovum prevents the abdominal ostium from closing. It is also possible that, even in cases where the ostium has partially closed, its dilatation may be effected by the pressure of the growing ovum, which may then be expelled through the ostium.

Tubal abortion most usually occurs during the first or second month. Out of sixty-one cases recorded by Mackenrodt and Martin, abortion occurred in twenty-one cases in the first month, in twenty-nine cases in the second month, in eight cases in the third, and in three cases in the fourth. The entire ovum may be expelled, or it may still remain in part adherent to the tube. Its expulsion is probably due to the contraction of the muscular coat of the tube, or to the accumulation of blood at the proximal side of the ovum, an accumulation which, as it increases, gradually pushes the ovum in the direction of least resistance. It is probable that, in the majority of cases of tubal abortion, the ovum has become converted into a mole either before the abortion commences or whilst it is in process. In some cases, however, an uninjured ovum may be thus expelled.

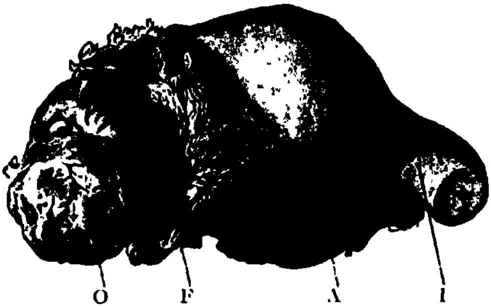

FIG. 293.—A TUBAL ABORTION.

O, Ovum in process of expulsion ; F, dilated abdominal ostium , A, ampulla of tube ; I, isthmus of tube (Bumm.)

The consequences of tubal abortion are very similar to those of intra-peritoneal rupture, but, as a rule, the hæmorrhage occurs more gradually, and, in consequence, the formation of a hæmatocele is relatively more common than in the case of tubal rupture.

Even if such is the termination of the case, the mother may die in consequence of the steady persistence of the hæmorrhage, especially in cases in which the ovum still remains partially adherent to the tube.

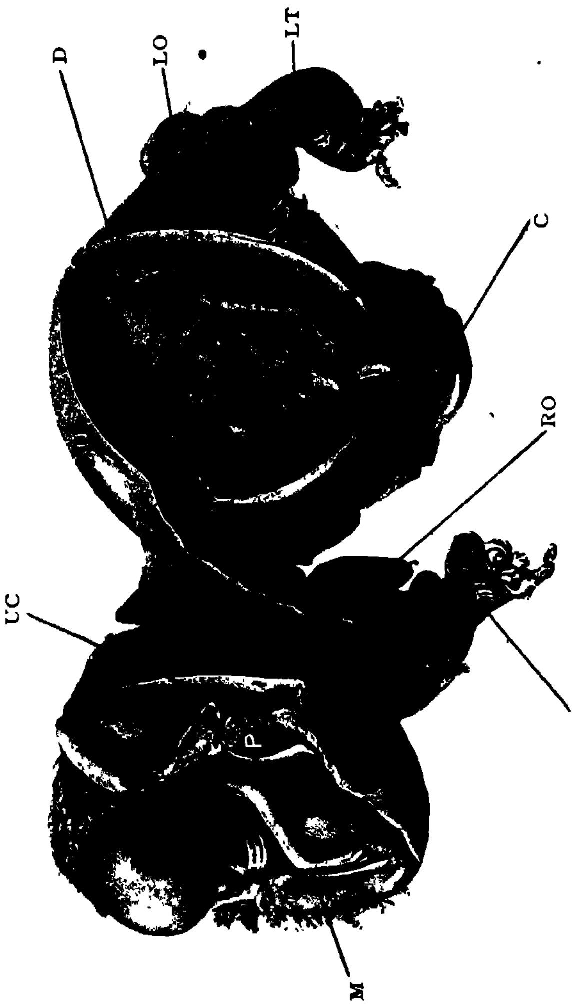

FIG. 294.—PREGNANCY IN THE RUDIMENTARY HORN OF A TWO-HORNED UTERUS.
U, Uterus; D, decidua; UC, right uterine cornu, P, placenta, M, chorion; RO, right ovary, RT, right tube, LO, left ovary, LT, left tube C, cervix.
(From a specimen in the Museum of the Royal College of Surgeons in Ireland.)

Cornual Pregnancy.—A few words must be said here on the subject of pregnancy occurring in the rudimentary horn which may be found in association with a uterus bi-cornis. Such a pregnancy is extremely rare, so much so that, in 1888, only thirty-four cases were known (Himmelfarb*). The course of cornual pregnancy is practically the same as that of tubal pregnancy. In the great majority of cases, rupture occurs, usually accompanied by hæmorrhage, which proves fatal unless checked. In rare instances, the ovum may continue to develop. The period at which rupture occurs is dependant upon the degree to which the cornu has developed.

The relations of the rudimentary cornu to the well-developed cornu render it difficult at first sight to distinguish a case in which pregnancy has occurred from a tubal pregnancy, even on post-mortem examination. The following anatomical relations will, however, usually allow a diagnosis to be arrived at (Webster†):—

(1) In infundibular and ampullar pregnancies, the round ligament is found attached to a normal uterus on the uterine side of the gestation sac. The normal appearance of the Fallopian tube is greatly altered, owing to the presence of the ovum.

(2) In cornual pregnancy, the round ligament is external to the gestation sac. The unimpregnated horn differs markedly in shape from the normal uterus. The Fallopian tube is found attached to the pregnant horn, and is not necessarily altered. The pregnant rudimentary horn is attached to the opposite well-developed horn at the upper end of the cervix.

(3) It may be difficult to distinguish an interstitial from a cornual pregnancy. In both cases the round ligament is external to the gestation sac, though if the pregnancy is partly interstitial, and partly isthmial, it may be attached to the anterior aspect of the sac. The close incorporation of the sac with the rest of the uterus and the absence of a separate horn will help, however, to distinguish the interstitial from the cornual pregnancy.

THE CLINICAL ASPECT OF EXTRA-UTERINE PREGNANCY.

We now come to discuss the symptoms, diagnosis, and treatment of the various phases of extra-uterine pregnancy, and in doing so we shall divide the pregnancy into three periods, each of which will be discussed separately. These periods are:—

(1) Before rupture of the gestation sac.
(2) At the time of rupture of the gestation sac.
(3) After rupture of the gestation sac.

BEFORE RUPTURE OF THE GESTATION SAC.—This period commences at the time of the implantation of the ovum in the tube, and ends with the commencement of rupture of the gestation sac. We have already pointed out that, so far as the symptoms of the patient are concerned, there is rarely more than one rupture, as, if the symptoms of primary rupture are sufficient to draw attention to the nature of the case, either the ovum or the mother will die, or the former will be removed by operation. Consequently, in those cases in which secondary rupture occurs, the first rupture has caused so slight symptoms that its occurrence has escaped notice.

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* 'Ueber Nebenhornschwangerschaft,' *Munchen. Med. Wochen.*, 1888, Nos. 17 and 18.

† *Op. cit.*, p. 87.

Symptoms.—Special symptoms, which might serve during the first period of extra-uterine pregnancy to distinguish between a case of extra- and intra-uterine pregnancy, are in the main characterised by their absence. In many cases, there is nothing which can serve to direct the attention of either the patient or her medical attendant to the nature of the case. The usual symptoms of pregnancy are present, save that the menstrual history may be quite atypical. The patient may give the usual history of amenorrhœa; she may have menstruated regularly up to the date of rupture of the sac; or, she may have menstruated for the first couple of months, and then—in a case where the occurrence of the primary rupture was not noticed—she may have missed two or three periods. The amount and nature of the menstrual flow may be normal, or it may be very slight and altered in character. Lastly, the patient may suffer from repeated attacks of menorrhagia, or from an almost continuous hæmorrhagic discharge. In most cases, it is probable that the hæmorrhage is due to the detachment of small pieces of the decidua which forms in the uterine cavity, due to a recurrent monthly congestion, or to degeneration of the decidua. More rarely, it is possible that, in cases of tubal mole, the blood—in part at any rate—comes from the tube. Such an occurrence is of course only possible if the tube remains patent at the uterine side of the ovum. It is probable that, if these uterine discharges could be examined, in most cases shreds of decidua would be found in them, a discovery which would be of great assistance in arriving at a diagnosis of the nature of the case. In some cases, a complete decidua is expelled, even prior to the occurrence of rupture. Irregular and intermittent pains, referred to the lower part of the abdomen and back, are of relatively common occurrence. They are probably due to contractions of the uterus, provoked by the presence of the decidua, and may possibly be sometimes caused by contractions of the muscle fibre in the walls of the gestation sac. They are most irregular in their occurrence, and in some cases may be absent. Similar pains are also of not infrequent occurrence in cases of intra-uterine pregnancy.

The results of a physical examination are more definite. The usual signs of pregnancy are to be found, including enlargement of the uterus. The latter, however, as well as the other uterine phenomena of pregnancy, are not so well marked as in a case of intra-uterine pregnancy. In a favourable case, it ought to be possible to detect the enlarged tube by means of a bi-manual examination at any time after the end of the fourth week. It is then felt as an oval swelling to one side of the uterus or in

Douglas's pouch. The tumour pulsates, and corresponds in size with the period of pregnancy. a In a case of interstitial pregnancy, the tumour is incorporated with the uterus, to which it imparts an asymmetrical shape. b In an isthmial pregnancy, it is just possible to determine that the swelling is not incorporated with the uterus, but that it is quite distinct. c While, in an ampullar pregnancy, the swelling is connected with the uterus by a pedicle, formed of the remainder of the tube, and consequently has a certain range of motion, unless fixed by adhesions. d As the ovum increases in size, the position of the uterus is altered. It is usually displaced to the opposite side, or forwards, according as the enlarged tube is lying to one or other side of the uterus or in Douglas's pouch. e When the tube has ruptured into the broad ligament, the upper part of the vagina, as well as the uterus, may be displaced to the opposite side. In such cases, it may also be possible to obtain internal ballottement, particularly if the placenta happens to be situated above the fœtus. If it is below the fœtus, it will mask the ovum to such an extent that it would be impossible to feel the fœtus from below.

Diagnosis.—The diagnosis of an extra-uterine pregnancy prior to rupture can usually be made with reasonable certainty, once the ovum has reached a sufficient size to be palpable, provided that the symptoms of the patient lead her medical attendant to make a bi-manual examination. Unless the diagnosis is obvious, the patient should in all cases be examined under an anæsthetic, in order to obtain relaxation of the abdominal muscles, and to allow a more complete examination to be made. Leaving interstitial pregnancy on one side, the chief points on which we rely are a the presence of the subjective symptoms of pregnancy with perhaps an anomalous menstrual history, b and of the objective symptoms with certain alterations in those furnished by the uterus. a The latter is enlarged, but not to such an extent as the period of pregnancy would demand. b It preserves its normal unimpregnated shape, instead of assuming the globular outline characteristic of intra-uterine pregnancy. c The usual softening of the cervix is but slightly marked, d and the softening of the lower uterine segment—Hegar's sign of pregnancy—is absent. e A swelling can be felt to one or other side of, or behind, the uterus, corresponding in position to the Fallopian tube, and in size to the period of pregnancy. It is distinguished from other tubal swellings by the size of the bloodvessels which run in connection with it, by the fact that it is unilateral, and that in some cases at least it is fairly movable. If rupture into the broad ligament has already occurred, the swelling will be situated in the broad ligament, and will be larger than the period of pregnancy would suggest, on account of the usual accompanying extravasation of blood. If the fourth month has been reached, it may be possible to obtain internal ballottement.

It may be most difficult or impossible to distinguish between an ampullar pregnancy and a small ovarian cyst, particularly in cases in which the fimbriated extremity of the tube and ovary are in apposition. If the history of the case and the absence of the symptoms of pregnancy are not in themselves sufficient to enable a distinction to be made, it may be possible to make one by noting the relation of the ovarian ligament to the tumour,[1] but more frequently such cases will only be cleared up by means of an exploratory cœliotomy. Such a procedure is quite justifiable, as whether the case is one of tubal pregnancy or of ovarian tumour, the swelling requires to be removed.

Treatment.—The treatment of these cases can be given in a very few words. As soon as the nature of the case is recognised, or even before it has been recognised, if there is reasonable cause for believing that the case is one of extra-uterine pregnancy, the abdomen must be opened and the tube containing the ovum removed. The abdomen may be opened by either the ventral or the vaginal route, but, in the majority of cases, the former route is preferable. In many cases, however, the operation may be easily performed by the vaginal route. If, however, the ovum has passed into the broad ligament, the abdominal route should be always chosen, as it enables a more full view to be obtained of the field of operation.

The steps of the operation do not call for description, save in the case of a broad ligamentous pregnancy, in which very great difficulties may arise in consequence of the presence of the placenta. The procedures which are adopted at this period of pregnancy are, however, almost identical with those which are adopted in cases that go to term, and, consequently, we shall postpone their description until we are discussing the latter cases.

All such procedures as the injection of morphia into the fœtus, or the use of strong electrical currents, with the object of killing the fœtus, must be unhesitatingly condemned. They are both dangerous and uncertain in their action, and, consequently, have no place in the modern treatment of extra-uterine pregnancy.

At the Time of Rupture of the Gestation Sac.—This period includes the occurrence of rupture of the gestation sac, either primary or secondary, whichever is of clinical importance. It must be remembered that in some cases, clinically, this period is not met with, as primary rupture may give rise to no special symptoms, and secondary rupture may not occur.

Symptoms.—The two chief symptoms to which rupture of the gestation sac gives rise are hæmorrhage and pain. These are common to every case, but their degree of intensity depends upon the nature and consequences of the rupture. There is also, in almost every case, a hæmorrhagic discharge from the uterus, accompanied by the expulsion of a complete decidual cast of the uterus or of fragments of decidua.

We must return for a moment to what has been already said regarding the consequences of tubal rupture. Rupture may be intra-peritoneal or extra-peritoneal. The occurrence of the former may lead to diffuse hæmorrhage into the peritoneal cavity, or to the formation of a pelvic hæmatocele; the occurrence of the latter may lead to diffuse sub-peritoneal hæmorrhage, or to the formation of a hæmatoma of the broad ligament. In cases of secondary rupture into the broad ligament, it is probable that the hæmorrhage is always diffuse.

As is to be expected, diffuse intra-peritoneal hæmorrhage gives rise to very serious symptoms. In consequence of the blood lost, the patient becomes collapsed, and blanched, with usually a rapid and thready pulse, and a falling temperature. She is extremely restless, and wears an anxious expression. If a very large quantity of blood is lost, her respirations become rapid and sighing, and she seems unable to obtain sufficient air—'air-hunger.' Occasionally, the onset of the hæmorrhage, if gradual, is marked by slowing of the pulse. The occurrence of pain is very marked. At the moment rupture occurs, the patient may complain of a sensation as if something had torn internally, and this is succeeded by a continuous and violent abdominal pain. In some cases, this is so severe that it may be difficult to determine whether the accompanying collapse may not be due altogether to it. The abdomen is also usually tympanitic and tender.

Bi-manual examination in the case of rupture occurring before the end of the third month will furnish little or no information. If the presence of a tumour to one or other side of the uterus has been ascertained beforehand, it may be possible to determine its disappearance, and at the same time to recognise the fact that the uterus is enlarged. Bi-manual examination, and abdominal palpation, should be avoided as much as possible, unless we are prepared to open the abdomen immediately, as, by interfering with the formation of adhesions, and the clotting of the blood round the site of rupture, these procedures may remove the slight chance which Nature affords of checking the hæmorrhage. Moreover, the distended and tender condition of the abdomen usually renders it impossible to obtain any information of value. The same remark applies to the performance of percussion in different positions of the patient with the object of detecting alterations of position in the fluid. It is possible that, if a very large quantity of blood has escaped, we may obtain dulness in the flanks changing very slowly with change of position (Mayo Robson*), but, if such a quantity of blood has escaped, the surgeon has not time to spend in such formalities. On the other hand, in rupture occurring after the formation of the placenta it will, usually, be possible to determine the presence of the ovum, either by abdominal or vaginal examination.

If a hæmatocele is forming, the symptoms of the patient are not so intense as they are in cases of diffuse hæmorrhage, inasmuch as the hæmorrhage is gradual. If the hæmatocele has formed, it will be possible to determine its presence by a bi-manual examination. In such cases, a large boggy tumour will be found in Douglas's pouch. Below, this tumour fills the pouch exactly and causes it to bulge downwards and forwards into the vagina. Above, it is dome-shaped, but the outline may be obscured by the presence of adherent intestines. If the finger is passed into the rectum, the latter is, in the early stages, flattened out. Later, as the blood coagulates, the upper part of the rectum is invested by a hard ring of coagulated blood which almost completely surrounds it. The uterus is usually displaced forwards, but in the rare cases in which it was retroverted before the occurrence of hæmorrhage, it may be displaced still further backwards.

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* 'Ectopic Pregnancy,' *Medical Press and Circular*, January 25, 1898.

The symptoms of diffuse sub-peritoneal hæmorrhage are in the main similar to those of diffuse intra-peritoneal hæmorrhage, with the association of pressure symptoms due to the presence of blood beneath the pelvic peritoneum. Collapse occurs in proportion to the amount of blood lost. Pain in these cases may be very great, owing to the disruption of the tissues. As the blood clots, compression of the urethra and rectum may result, giving rise to difficulty in micturition, to tenesmus, and to partial rectal obstruction.

The symptoms caused by the formation of a hæmatoma in the broad ligament are usually slight. The patient may or may not have noticed the occurrence of a sudden pain followed by faintness. If the hæmatoma is large, the pain may continue. On examination, a tumour which closely resembles a unilateral parametritis is found. It displaces the uterus to the opposite side, and in extreme cases may extend posteriorly round the rectum.

Diagnosis.—Rupture of the gestation sac in extra-uterine pregnancy has to be diagnosed from the different phases of abortion, from perforation of the intestine, and from rupture of any other abdominal or pelvic viscus or tumour. Further, a retro-uterine hæmatocele must be diagnosed from a retroverted pregnant uterus, or—if of some standing—from a case of double salpingo-oöphoritis; and a hæmatoma of the broad ligament must be diagnosed from a unilateral parametritis. The diagnosis between extra-uterine pregnancy and abortion must be fully discussed, but this will be done in the chapter on the hæmorrhages of pregnancy.

The diagnosis from perforation or from rupture of any other viscus or tumour is made from the history of the case, which will tend to show the existence of pregnancy, and the non-existence of any condition which could cause perforation or rupture elsewhere than in a gestation sac. The expulsion of a decidua will be strong proof in favour of pregnancy. In some cases, perforation or some similar condition may synchronise with the occurrence of an abortion, and, in such cases, if the débris which has escaped from the uterus has been thrown away, the diagnosis will be almost impossible. This is, however, of little or no consequence, as in all such cases where it is obvious that something has ruptured into the peritoneal cavity, the indication is to open that cavity and determine what exactly has ruptured. Such a course is correct treatment, but to waste valuable time in endeavouring to make an exact pre-operative diagnosis is incorrect treatment.

The diagnosis between a recent hæmatocele and a retroverted pregnant uterus is often a difficult matter. In both instances, a bi-manual examination reveals the presence of a tumour filling the pelvis, displacing the upper part of the vagina forwards, and compressing the rectum against the sacrum, and in both instances there is a history of pregnancy. The points by which a diagnosis can be made have been already referred to, as well as the necessity for making a correct diagnosis at the earliest possible moment. In all cases of doubt, the patient should be examined under an anæsthetic, and if, even then, a diagnosis cannot be arrived at, it may be necessary to pass the sound into the uterus to determine its position. This is, of course, a procedure which must not be resorted to unless all other means of making a diagnosis fail, as, if the case is one of retroversion, it will almost certainly cause the expulsion of the ovum. It is, however, better to adopt such a course as a last resource rather than to run the risks of attempting to 'replace' a hæmatocele, or to leave a pregnant uterus in a condition of incarceration.

The diagnosis between a hæmatoma of the broad ligament and a unilateral parametritis can be made from the history of the case and from the absence of high temperature or other febrile symptoms, and will not usually present any difficulty.

Treatment.—In all cases of diffuse hæmorrhage, whether intra- or extra-peritoneal, and in all cases in which the hæmorrhage is continuing, even though a hæmatocele may be in process of formation, the only treatment possible consists in opening the abdominal cavity and ligating and removing the ruptured tube. This is a simple procedure in cases of primary rupture. If, however, the case is one of secondary rupture of the gestation sac at a period when the placenta has formed—*i.e.*, after the commencement of the fourth month—the treatment of the case is not so simple. It will be referred to in discussing the treatment to be adopted after the occurrence of rupture, when we shall discuss the subject of extra-peritoneal gestation generally.

The correct treatment of a pelvic hæmatocele cannot be so definitely laid down. As we have already seen, there are two terminations possible in the case of a hæmatocele—the blood may be absorbed aseptically, or infection may take place and an abscess may form. It is unnecessary to operate upon the cases which would be absorbed, but, if a hæmatocele which has been left alone subsequently suppurates, the prognosis is worse than if it had been operated upon before suppuration occurred. The principles of treatment are quite plain—if a hæmatocele will be absorbed aseptically let it alone, if, on the other hand, it is going to suppurate remove it; the difficulty is to apply them, as we can never be certain what will be the subsequent course of the case. We do, however, know that the smaller a hæmatocele is, the more likely is it to be absorbed, the larger it is, and the older the escaped ovum, the more likely it is to suppurate. Accordingly, we may regard as accepted the principle that every large hæmatocele, no matter what the age of pregnancy, and every hæmatocele in which the patient was more than three months pregnant, should be removed at the earliest date possible, and by a large hæmatocele we mean one which more than fills Douglas's pouch. In the case of small hæmatoceles, it is probable that every operator is and will be governed by his own experiences, and results. One operator will consider it advisable to operate on every case and remove the clots, while another will prefer to trust to absorption taking place. Which line of treatment is best can only be decided by statistics, and they are not as yet available. If suppuration has occurred, or if there is evidence of its commencement, the remains of the hæmatocele should be immediately removed.

A hæmatocele can be removed by the abdominal route or by the vaginal route. The latter is certainly the correct one in all cases in which suppuration has occurred, and is probably the correct route in all cases. An opening is made through the posterior vaginal fornix into the bottom of Douglas's pouch, and the clots are removed with the finger. The ovaries and tubes are then drawn down and examined. If the tube is found to be seriously damaged, it must be removed. In cases in which suppuration is commencing, or has already occurred, great care must be exercised to avoid breaking through the limiting adhesions which shut the hæmatocele off from the general peritoneal cavity. In such cases, and also in cases in which there is persistent oozing after the removal of a non suppurating hæmatocele, the pelvis is plugged firmly with iodoform gauze, the end of which passes into the vagina. This gauze is removed the following day. In aseptic cases, there is no necessity to replug the pelvis, but in suppurative cases the pelvis must be replugged daily, until the temperature of the patient and the cessation of purulent discharge shows that the further plugging is unnecessary.

The removal of a hæmatocele by the abdominal route does not call for any special description. If, on opening the abdomen, it is found that infection of the hæmatocele has occurred, a counter-opening should be made from the floor of Douglas's pouch into the posterior vaginal fornix, and the pelvis drained into the vagina by means of gauze plugging. The wound in the abdominal wall may then be closed. A hæmatoma of the broad ligament rarely calls for interference, as, if left alone, it will be almost invariably absorbed aseptically. Should suppuration occur, the resultant abscess must be opened and drained, if possible, from the vagina.

AFTER RUPTURE OF THE GESTATION SAC.—This period commences after the rupture of the gestation sac, and terminates with the removal of the ovum, whenever that may occur. For the sake of convenience, we shall also discuss here the treatment of the rare cases in which a tubal pregnancy reaches full term without causing rupture of the tube.

Symptoms.—We are now concerned with the symptoms of extra-uterine pregnancy during the last half of pregnancy. In some of these cases the ovum may be implanted in an unruptured tube, in other cases in an unruptured sac formed of the broad ligament, and in a third class of cases it may be free in the abdominal cavity. In the first class of cases, no rupture of the gestation sac has occurred. In the second class, the tube has ruptured into the broad ligament, but, inasmuch as the pregnancy has continued, the symptoms of rupture may have been so slight as to have escaped notice. In the third class of cases, the tube may have ruptured directly into the peritoneal cavity; or, it may have ruptured first into the broad ligament, and the secondary gestation sac thus formed may have then ruptured into the peritoneal cavity. In these cases, also, inasmuch as the ovum survived, it is probable that the symptoms of rupture were so slight as to have escaped notice.

It is probable that the presence of an extra-uterine pregnancy does not give rise to any special symptoms during the second half of pregnancy, and that the patient may arrive at full term quite unconscious that anything is the matter. Usually, the only special symptom to which the condition gives rise is the greater ease with which the movements of the fœtus can be felt by the patient, and the pain to which they sometimes give rise. When term is reached, uterine contractions as a rule ensue, and a more or less complete decidual cast of the uterus may be expelled. Shortly after this, the patient notices a cessation in the fœtal movements, due to the death of the fœtus.

The physical signs of an extra-uterine pregnancy are usually better marked than are the symptoms, but it is quite possible to overlook them if the obstetrician examines the case—as is usually done—without any thought as to the possibility of the presence of an extra-uterine pregnancy in his mind. The first point that the examiner may notice is the ease with which the fœtal parts are felt and recognised, and the distinctness with which the fœtal movements are felt. This is particularly marked in cases in which the fœtus is free in the abdominal cavity; if it is lying in an extra-peritoneal sac, and if the placenta is adherent to the anterior abdominal wall, the reverse may be the case. Next, a small tumour the size of an orange may be found pressed to one or other side of the false pelvis, and apparently adherent to the sac in which the fœtus is contained. This tumour is formed by the empty uterus. In some cases, however, the uterus may be displaced backwards or downwards, and so may not be palpable. On vaginal examination, prior to the onset of spurious labour, the cervix may not be as soft as is usually the case in pregnancy, otherwise there will be little to direct attention to the condition. 4 When labour has apparently commenced, the non-occurrence of dilatation of the cervix and of descent of the presenting part may in some cases be the first sign to draw attention to the nature of the case. Then, on careful bi-manual examination, it may be possible to determine the connection between the laterally-placed tumour in the false pelvis and the cervix.

After the death of the fœtus, the liquor amnii is gradually absorbed and the abdominal enlargement commences to grow smaller. 7 The fœtal heart can be no longer heard, nor the fœtal movements felt. Still later in the course of the case, as one or other of the various changes that have been already described occur in the fœtus, the outlines of the latter become indistinct, and, instead of being able to palpate fœtal parts, all that can be felt is an oval tumour, portions of which are more resistant than are other portions. 4 If an aseptic change in the fœtus takes place, the patient may carry the latter for years without suffering very much, save from pressure symptoms and from the size and weight of the tumour. If suppuration occurs and an abscess forms, all the symptoms of septic absorption will be present.

Diagnosis.—The diagnosis of extra-uterine pregnancy can, as a rule, be made with comparative certainty in all cases in which the symptoms are sufficiently marked to draw the attention of the patient to her condition, and to lead her medical adviser to examine her systematically. In many instances, however, the patient may not suspect that there is anything abnormal in the pregnancy, and it may be that the condition is only recognised, during the course of spurious labour, on account of the non-descent of the presenting part. Further, in still other cases, the symptoms of spurious labour may be so slight that they come and go unnoticed, and then attention may only be drawn to the condition by the gradual shrinkage of the abdominal tumour, and by the fact that the date fixed for the confinement is past.

There are two steps in the diagnosis of extra-uterine pregnancy during this period. 1 The first step consists in determining the existence of pregnancy, 2 the second step in determining that the pregnancy is extra-uterine.

1 The diagnosis of pregnancy is a comparatively simple matter. At the period with which we are now dealing, it will be possible to obtain the positive signs of pregnancy, *i.e.*, the fœtal heart, the fœtal parts, and the fœtal movements. In cases in which the fœtus is dead, it will, of course, be impossible to obtain the first and the last sign, and if death occurred many weeks prior to the examination of the patient, it may be also impossible to palpate the fœtal limbs on account of the post-mortem changes which have taken place in their tissues. In such cases, we must rely on the history of the patient, supported as it will be by the presence of an abdominal tumour.

2 The determination that the pregnancy is extra-uterine is a more

difficult matter, and even if a careful bi-manual examination is made, the difficulty of diagnosing the condition is often very great. This difficulty in the main arises from the actual or apparent close connection between the gestation sac and the uterus. Practically, we may consider that the gestation sac is found in three relations to the uterus. First, it may be quite distinct and easily separated from the latter. This is the usual relation in cases of secondary abdominal pregnancy during the first half of the period with which we are dealing, that is to say, before the ovum has filled the abdominal cavity. Secondly, it may be actually attached to one or other side of the uterus. This again is the usual relation in cases of unruptured broad-ligamentous pregnancy, or of interstitial pregnancy. Thirdly, it may be apparently attached to the uterus in consequence of its being pressed against it by the pressure of the abdominal walls. This will naturally happen, as soon as the ovum has reached such a size that it fills the entire abdomen.

When we are able to determine the presence of a tumour distinct from the uterus, and inside which there is a fœtus, the diagnosis is made. The only point in such cases is to eliminate the possibility of a co-existent intra-uterine pregnancy. This can be done in the usual manner by noting the size of the uterus.

In the second and third class of case, we find a gestation sac occupying the abdomen, and to one or other side of it is affixed a small mass of firmer consistency than the sac itself. Such a condition may be due to several different causes. In the first place, and perhaps most commonly, the gestation sac may be formed in the usual manner by the enlarged uterus, and the smaller tumour to the side may be a myoma. Next, the smaller tumour may be the uterus, and the gestation sac may be formed by the broad ligament, or the ovum may be free in the abdominal cavity and only in apparent connection with the uterus. And, lastly, the gestation sac may be formed of one horn of a bicornuate uterus or one half of a double uterus, the smaller tumour being formed by the other cornu or half of the uterus as the case may be. In uterine pregnancy, complicated by a myoma, there is nothing in the history or the symptoms of the patient to suggest extra-uterine pregnancy. The painless contractions of the uterus are felt in the ordinary manner, and the softening of the cervix and lower uterine segment, and the other objective uterine symptoms of pregnancy, are present. The greater the amount of liquor amnii, or, in other words, the greater the size of the gestation sac, the greater will be the difficulty of diagnosis, as the small empty uterus may be so completely hidden by the larger tumour that it is impossible to recognise its presence. In such cases, the only course to adopt is to wait until it is obvious that term has passed, as shown by the death of the fœtus and the commencing diminution in size of the gestation sac. If term is passed and the fœtus is dead, the passage of the sound will furnish positive evidence. If the smaller tumour is the uterus, the sound will pass into it; if the larger tumour is the uterus, the sound will pass into it.

If the smaller tumour is a non-impregnated uterus, and the gestation sac is between the layers of the broad ligament or free in the abdominal cavity, it may be possible on careful examination to determine that the cervix is continuous with the smaller tumour. Also, the objective uterine signs of pregnancy will not be so marked as if the pregnancy was intra-uterine. If it is allowable to pass the sound, it will again make the diagnosis obvious. Pregnancy occurring in one half of a double uterus will, according to Taylor,[*] only confuse those who have no knowledge of the condition. The presence of a double cervix can be determined by vaginal examination, or by inspection through a speculum. Where pregnancy occurs in one horn of a two-horned uterus, the non-impregnated horn forming the smaller tumour, the diagnosis is very much more difficult. It is probable that such cases will be mistaken for the more common condition to which we have already referred, *i.e.*, a uterine pregnancy complicated by a small myoma at one or other side. Usually, labour will proceed in the ordinary manner and the fœtus be expelled. Where there is no connection between the pregnant horn and the cervix, the nature of the case will only be determined during labour, in consequence of the non-dilatation of the uterine orifice. Such a case is, to all intents and purposes, a case of extra-uterine pregnancy.

It is probable that, in some cases, a diagnosis will only be made by waiting until the onset of spurious labour and the death of the fœtus have made it permissible to introduce the sound. If the latter passes into the gestation sac, we know that we are dealing with a case of missed labour. If, on the other hand, it passes into a smaller cavity at the side of the gestation sac, we know that we are dealing with some form of extra-uterine pregnancy, or with a pregnancy contained in a uterine cornu, which is not in communication with the cervix.

Treatment.—The treatment of extra-uterine pregnancy during this stage is as yet far from being clearly laid down. The ideal line of treatment consists in waiting until full term, then opening the abdomen and removing a living fœtus and the gestation sac and placenta. This procedure is, however, a most difficult and dangerous one, as at term the placental vessels have reached their full size, and the difficulty of removing the placenta without at the same time causing hæmorrhage which cannot be checked, is very considerable. At an earlier period in pregnancy, the vessels are smaller than at term, and some weeks after term they are also smaller on account of the shrinkage of the placenta consequent on the death of the fœtus. Accordingly, we must at present consider that though an operation at term offers the most favourable prospect for the fœtus, it offers the most unfavourable prospect for the mother, and must therefore, in most cases, be rejected.

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[*] *Op. cit.*

It is by no means easy to lay down definitely what is the best time at which to operate in a case in which the existence of an extra-uterine pregnancy is recognised as early as the fifth month. Several points have to be taken into consideration. It is impossible in most cases to tell, without opening the abdomen, the exact position of the ovum, and, consequently, it is impossible to be sure that secondary rupture of the sac may not occur at any moment. Accordingly, the dread of secondary rupture makes us inclined to operate at once. On the other hand, according to Pinard, the danger of operating during or after the fifth month differs but little from the danger at term, so far as hæmorrhage from the placental site is concerned, as by this time the placenta is of considerable size.* A third course must also be taken into consideration. If the removal of the fœtus is postponed until some weeks after full term, the placenta will by that time have shrunk and its vessels become smaller. Consequently, the danger of hæmorrhage during the removal of the placenta is not so great. This course, however, means the certain loss of the fœtus, and there is also some risk that putrefactive changes may take place in the ovum.

We may then, perhaps, consider that, if the physical signs lead us to believe that the fœtus is free in the abdominal cavity, and that, consequently, there is no danger of secondary rupture, the operation may be postponed until at or after full term. 1 If the special circumstances of the case make it necessary to run any risk in order to save the fœtus, operation may be undertaken at term. If, on the other hand, it is considered advisable to consult the interests of the mother alone, operation had better be postponed until several weeks after term. 2 If the examination of the patient goes to show that the fœtus is probably lying in the broad ligament, it is probably best to operate on the case as soon as it is diagnosed, unless the condition is not recognised until near full term, when the fœtus has reached its full size and the risk of secondary rupture may be ignored.

The operation for the removal of an extra-uterine pregnancy in which there is a fully-developed placenta is most difficult, on account of the presence of the placental vessels. There are four courses, one of which it may be possible to adopt:—

(1) After the removal of the fœtus, the sac and placenta may be extirpated, the vascular attachments of the latter being gradually separated after ligation of the vessels. This is the ideal course, and it can usually be carried out in all cases in which the operation has been postponed for some weeks after term, as by that time the vessels going to the placenta have in great part become obliterated.

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* *Bull. de l'Académie de Médecine*, August 6, 1895

(2) If there is a distinct sac in which the fœtus is contained, after the removal of the latter the edges of the sac are stitched to the opening of the abdominal wall, the cord is brought out through the same opening, and the sac is plugged with iodoform gauze. This gauze may be left *in situ* for two or three days, or if there is any elevation of temperature, it may be changed daily. At the end of fifteen to twenty days the patient is again anæsthetised and the placenta removed, any hæmorrhage being checked either by ligation of a bleeding vessel or by plugging the sac with gauze. If the removal of the entire placenta is effected, the abdominal wound may be closed by sutures, or, if considered necessary, the cavity may be drained until it becomes obliterated. This is probably the best course to adopt in cases which are operated upon during the life of the fœtus.

(3) The third procedure consists in cutting the umbilical cord close to its insertion, and allowing the placenta to remain permanently in position, the abdominal wound being closed. Cases have been recorded in which this procedure has been adopted with success. It is, however, by no means free from risk, on account of the danger of infection of the placenta from the intestines, and is at best a *dernier ressort.*

In the majority of cases, it is advisable to commence the initial incision in the abdominal wall midway between the umbilicus and the symphysis. If the fœtus is lying in an extra-peritoneal sac, it is always well to endeavour to open directly into the sac without opening into the peritoneal cavity, and, consequently, the incision should be as near to the symphysis as is possible without wounding the bladder. If it is clear that the sac is situated to one or other side, a lateral incision over Poupart's ligament may take the place of a median one, but, usually, it will be found best to make the median opening first, and then, if it is found that an opening in a different place will enable us to reach the ovum more advantageously, such opening may be made and the initial incision closed.

CHAPTER IX

ANTE-PARTUM HÆMORRHAGES

Hæmorrhages occurring during the First Three Months—Differential Diagnosis—Hæmorrhages occurring during the Second Three Months—Due to Detachment of the Placenta.—Hæmorrhage occurring during the Last Four Months—Accidental Hæmorrhage; Concealed; External—Unavoidable Hæmorrhage—Fœtal Mortality in Accidental and Unavoidable Hæmorrhage—Hæmorrhage due to Rupture of the Uterus, Hæmorrhage arising independently of the Pregnancy—The Question of Menstruation during Pregnancy—Hæmorrhage from Tumours—Hæmorrhage from Traumatisms.

ANTEPARTUM hæmorrhages arising as a direct result of the pregnancy may be divided into three main groups:—

A. Hæmorrhages occurring during the first three months of pregnancy.

B. Hæmorrhages occurring during the second three months of pregnancy.

C. Hæmorrhages occurring during the last four months.

In adopting this classification, the duration of pregnancy is considered as ten lunar months of four weeks each. The first group includes hæmorrhages occurring before the full formation of the placenta. The second group includes hæmorrhages occurring from the time the placenta is formed to the time the fœtus becomes viable. The last group includes hæmorrhages occurring after the fœtus is viable.

HÆMORRHAGES OCCURRING DURING THE FIRST THREE MONTHS

The hæmorrhages of the first three months of pregnancy, which arise as a direct result of the pregnancy, have three chief causes:—abortion; extra-uterine pregnancy; and vesicular mole.

Inasmuch as each of these conditions has been already fully discussed, we shall here confine ourselves to a brief account of the methods of distinguishing between them.

In order to recognise the cause of hæmorrhage in any case, the following points must be ascertained:—

(1) The existence of pregnancy.
(2) The duration of pregnancy.
(3) The present size of the uterus, and the nature of any alterations which may take place in it from day to day.
(4) The condition of the adnexa.
(5) The nature and duration of the discharge.
(6) The nature of any solid matter which may have been expelled from the uterus.
(7) The condition of the cervix.
(8) The symptoms of the patient.

The Existence of Pregnancy.—The existence of pregnancy is the first point to be decided. This can be done by determining the presence of its usual subjective and objective symptoms.

The Duration of Pregnancy.—The duration of pregnancy must be ascertained as far as possible by the patient's history, without taking the size of the uterus into consideration. This is an important point to remember, as in some cases the diagnosis of the nature of the case will be largely based upon the difference between the actual size of the uterus and the size it ought to be in accordance with the period of pregnancy.

3 **The Present Size of the Uterus, and the Nature of the Alterations which take place in it from Day to Day.**—The present size of the uterus is a considerable aid to diagnosis in cases of hæmorrhage, when it is taken in connection with the supposed date of pregnancy. 1 If the uterus corresponds in size with the duration of pregnancy, it is strong evidence for supposing that it contains a living ovum, or one which has only quite recently died. If, however, the uterus is larger than the period of pregnancy accounts for, the possibility of vesicular mole must be remembered. 3 If, again, the uterus is smaller than the period of pregnancy would lead us to suppose it ought to be, it suggests, first, that perhaps the pregnancy is extra-uterine, and, secondly, if that supposition is proved to be erroneous, that the ovum is probably dead.

The alteration in size of the uterus from day to day is also important. 1 If it increases at the natural rate, it is almost conclusive evidence that the ovum is intra-uterine and living. The only other condition under which this rate of increase could occur is in the case of a missed ab[illegible]ion, in which just sufficient intra-uterine hæmorrhage is taking [illegible]e each day to cause the same rate of increase that a growing ovum would cause. Such a state of affairs is necessarily so rare that in practice it may be neglected. 2 If the uterus ceases to increase in size, or even commences to become smaller, it is equally strong evidence that the ovum is dead, that is, that a condition of missed abortion is present. 3 If the uterus grows more rapidly than is normal, it is strongly suggestive of vesicular mole.

4 **The Condition of the Adnexa.**—The condition of the adnexa is

of importance, if the question of the possibility of the existence of an extra-uterine pregnancy arises. If the adnexa are normal on both sides, the possibility of extra-uterine pregnancy is immediately eliminated. a The typical condition met with in extra-uterine pregnancy prior to the rupture of the sac is as follows:—A globular or ovoid tumour, varying in size from a pullet's egg to an orange, is found at one or other side, corresponding in position to the tube of the same side. b The tumour is elastic to the touch, and slight pulsation may be felt in it owing to the increased size of the vessels which supply it. c The uterus, which is also somewhat enlarged, is displaced towards the opposite side by the tumour. d If rupture has occurred, it may be possible to determine the disappearance of a tumour whose existence had been previously ascertained, and the gradual formation of another tumour in Douglas's pouch.

The physical signs which help to distinguish between an unruptured tubal pregnancy and any other tumour of the adnexa are:—

(1) In tubal pregnancy the enlargement corresponds to the position of a tube rather than of an ovary. Ovarian pregnancy is said to occur, but it is so rare that it may be neglected.

(2) An extra-uterine pregnancy is usually unilateral. Inflammatory disease of the tubes is almost always bilateral.

(3) The sac of a pregnancy pulsates, and occasionally contractions of its walls may be felt (Kelly).

The Nature and Duration of the Discharge.—Slight hæmorrhagic discharge is not indicative of anything definite. It occurs in all forms of abortion, in extra-uterine pregnancy, and in vesicular mole. 2 Profuse hæmorrhage is conclusive evidence of some form of abortion, most probably threatened or incomplete. 3 A profuse, watery, blood-stained discharge points strongly to vesicular mole. If small cysts are found in it, it is pathognomonic of that condition. 4 More or less profuse dark-coloured discharge shows that the ovum is dead, and that part or all of it is still retained in the uterus. 5 Putrid discharge shows that the ovum is not only dead, but that decomposition has occurred. 6 If the discharge quickly lessens, and after a few days disappears altogether, it may usually be taken to show either that the danger of the expulsion of the ovum has passed off, or that the uterus has emptied itself—that is, that complete abortion has occurred.

The Nature of any Solid Matter which may have been expelled from the Uterus.—It cannot be too strongly insisted upon that, in the case of a patient who is bleeding, all matter which is expelled from the uterus must be most carefully examined. It is by so doing that, in the majority of cases, we obtain the necessary information to enable a diagnosis to be made. The expelled matter, if we can obtain it all, gives absolute information as to what has happened in the uterus, while the information obtained in other ways is generally more or less problematical. 1 If an entire ovum is expelled, it is self-evident that complete abortion has taken place, or, if only a portion, that the abortion is incomplete. In order to be absolutely certain that the case is one of abortion, either chorionic villi or some fragment of a fœtus must be found. A mere mass of decidua does not enable us at first sight to say whether the case is one of intra- or extra-uterine pregnancy; a microscopical examination of it will be necessary. Dakin states that the true decidua of an intra-uterine pregnancy is indistinguishable from the false decidua of extra-uterine pregnancy. However, in the former case, some fragment of chorion or amnion will be found by the aid of the microscope, and this, of course, is pathognomonic. 2 If intra-uterine pregnancy is excluded, the expulsion of a decidual cast of the uterus, in association with a growing pelvic tumour, is diagnostic of an extra-uterine pregnancy (Routh). 3 As has been mentioned above, the presence of cysts in the discharge is pathognomonic of vesicular mole.

7 **The Condition of the Cervix.**—The condition of the cervix is of assistance, not only in determining whether the patient is pregnant or not, but also in distinguishing between the different forms of abortion. 1 In a threatened abortion, the cervical canal usually becomes slightly patulous. If the ovum has been detached and is in process of expulsion, it is forced against the inner os, which accordingly dilates, the external os still remaining closed. The cervix as a result becomes conical in shape, the base of the cone corresponding with the cervico-vaginal junction, the apex with the external os (*v.* Fig. 295 A); in other words, the circumference of the cervix at the cervico-vaginal junction is increased. 2 If the external os will not dilate to allow the ovum to pass through, the latter is gradually expelled into the cervical canal, which dilates to a sufficiently large size to receive it. The inner os may then partially contract again, and the ovum become incarcerated in the ballooned-out cervical canal. Thus, the condition known as cervical abortion arises. 3 If, however, the external os dilates in the usual manner and the ovum is expelled, the inner os closes again completely, while the external os remains dilated for some days. The cervix thus acquires a trumpet-shape, the mouth of the trumpet corresponding to the external os (Fig. 295 B). If the ovum has been completely expelled, the cervix gradually regains its normal shape; if, on the contrary, a part of the ovum is retained, complete closure of the canal rarely occurs.

8 **The Symptoms of the Patient.**—The three chief symptoms of the patient in either abortion or extra-uterine pregnancy are hæmorrhage, pain, and collapse. 1 In abortion, the three have usually a due relationship to one another, and the degree of collapse is in proportion to the amount of hæmorrhage and pain which is occurring. The amount of pain is, however, by no means constant. 2 In the case of a ruptured extra-uterine pregnancy, on the other hand, the first point which may strike us

with regard to the case is that the collapse is altogether out of proportion to the amount of hæmorrhage which is apparently occurring. The accompanying pain is also greater than in abortion. Such a condition should always very forcibly suggest the possibility of internal hæmorrhage. In missed abortion, the previously existing subjective symptoms of pregnancy disappear, and are replaced by various ill-defined phenomena, the result of the absorption of ptomaines from the dead ovum.

The foregoing are the principal diagnostic phenomena to be looked for in any case of hæmorrhage during the first three months of pregnancy, and it may be of use to sum them up in their relationship to the various causes of hæmorrhage.

A uterus corresponding in size to the period of pregnancy; a

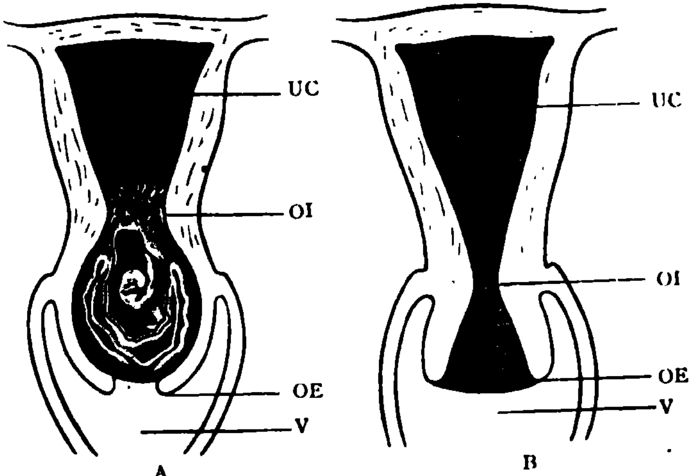

FIG. 295.—DIAGRAM SHOWING THE SHAPE OF THE CERVIX DURING AND SUBSEQUENT TO THE EXPULSION OF THE OVUM.

UC, Uterine cavity; OI, os internum: OE, os externum; V, vagina

varying amount of hæmorrhage and pain, with a corresponding degree of collapse; widening of the cervix at the cervico-vaginal junction; and a slightly patulous condition of the external os, are suggestive of threatened abortion.

Marked ballooning of the cervical canal; closure of the os externum, which has a thin parchment-like edge; and a varying amount of dark, perhaps putrid, discharge, are indicative of cervical abortion.

The expulsion of a portion of the ovum; slight diminution in size of the uterus; a patulous cervical canal; and a profuse dark discharge, or even a sharp hæmorrhage, are indicative of incomplete abortion.

4 The expulsion of the entire ovum; a trumpet-shaped condition of the cervix; a marked diminution in the size of the uterus; and the gradual diminution and final disappearance of all discharge, are indicative of complete abortion.

5 A cessation of development, or a gradual diminution in size of the uterus; a dark hæmorrhagic discharge, which may be fœtid; disappearance of the subjective and objective symptoms of pregnancy, and general ill-health on the part of the patient, are suggestive of missed abortion.

6 The existence of an ovoid and pulsating tumour at one side of the uterus; a history of pregnancy; an enlarged uterus, corresponding in size to, or slightly smaller than, the date of pregnancy accounts for; slight irregular hæmorrhages; and perhaps the expulsion of a decidua in which no trace of chorionic villi or amnion can be found, are suggestive of an unruptured extra-uterine pregnancy.

7 A varying degree of hæmorrhage; the expulsion of a decidua in which no trace of chorion or amnion can be found; considerable pain; collapse out of proportion to the amount of external hæmorrhage; and perhaps the disappearance of a previously-discovered pelvic tumour, with the formation of a new tumour in Douglas's pouch, are suggestive of a ruptured extra-uterine pregnancy.

8 Marked increase in size of the uterus, out of proportion to the period of pregnancy; a profuse watery blood-stained discharge, perhaps containing cysts; and crampy pains, are indicative of vesicular mole.

HÆMORRHAGES OCCURRING DURING THE SECOND THREE MONTHS

Three varieties of hæmorrhage are met with during the second three months of pregnancy:—

I. Hæmorrhage due to detachment of the placenta.
II. Hæmorrhage due to extra-uterine pregnancy.
III. Hæmorrhage due to degeneration of the ovum.

Hæmorrhage due to the last two causes has been already discussed, and consequently we are alone concerned with hæmorrhage due to the detachment of the placenta.

I. Hæmorrhage due to Detachment of the Placenta.

Hæmorrhages occurring during the second three months of pregnancy due to detachment of the placenta, occupy an intermediate position between abortion and accidental or unavoidable hæmorrhages.

With the exception of a small proportion of cases which are due to degeneration of the ovum, we find that, while ætiologically these hæmorrhages can be classified in the same manner as can the hæmorrhages of the last four months, clinically they must be treated as are those of the first three. The reason of this is obvious. In the four last months of pregnancy, it is always possible to distinguish clinically between the two great classes of hæmorrhage—*i.e.*, hæmorrhage coming from a normally situated placenta, and hæmorrhage coming from a placenta prævia; in the second three months of pregnancy, it is not possible to do so, although the two classes occur. Consequently, while in the four last months, we can diagnose exactly the nature of the case, and treat it accordingly in the most suitable manner, in the second three months all we can do is to recognise that the patient is bleeding, and that the hæmorrhage is either so trifling as only to require palliative treatment, or so serious as to demand more radical measures.

Ætiology.—As has been pointed out above, the hæmorrhage may come from a placenta which is normal in position, or from one which is prævia. The distinction between the two, which cannot be made prior to the expulsion of the ovum, can in most cases be made subsequent to that event. This is done by noting the relationship of the opening in the membranes, through which the fœtus was expelled, to the placenta, if there is such an opening. If the opening is quite close to the placenta, or even through the latter, it shows that the placenta must have been implanted quite close to, or right over, the os. In some of these cases, however, the ovum when expelled spontaneously is unruptured; while, in those cases in which it has to be removed, the membranes become so torn that it is impossible to determine the above relationship. Even in the cases in which the placenta is certainly prævia, it is doubtful whether its situation is the cause of its detachment, or whether, rather, the latter is not really due to such similar causes as act in the case of a normally seated placenta, the fact that the placenta is prævia being a chance accompaniment. The causes of the detachment of a normally situated placenta are to be found in some diseased condition of itself or of the decidua serotina, and are as follows:—Decidual endometritis; marked infarction of the placenta; syphilis, affecting either the placenta or decidua; and, perhaps, the situation of the whole or part of the placenta in the lower uterine segment.

Symptoms.—The essential symptom of these cases is the occurrence of hæmorrhage, perhaps accompanied by the death of the fœtus. In the large majority of cases, the hæmorrhage is external—*i.e.*, it escapes from the uterine cavity as rapidly as it finds its way into the latter from the bloodvessels. In a smaller proportion of cases, on the other hand, it may remain stored in the uterus, which gradually increases in size to suit the demands of the accumulating blood. If the area of placental detachment is so great as to leave an insufficient area of attachment to provide the necessary nutrition and oxygen for the fœtus, the latter dies. In most cases, this event will determine the onset of labour, but in some cases a condition analogous to missed abortion results, and the ovum is retained *in utero.* In the latter case, decomposition may result, if the membranes are ruptured; or, on the other hand, if they remain intact, the fœtus may merely macerate or mummify aseptically. On the other hand, if there is still a sufficient area of placenta intact to keep the fœtus alive, the latter continues to grow. If the fœtus lives and the hæmorrhage is external, the uterus increases in size in proportion to the advance of pregnancy. If the fœtus dies, the hæmorrhage being still external, the uterus diminishes in size as the liquor amnii is absorbed, and the symptoms due to the retention of a dead fœtus appear; the breasts become flaccid, any secretion which may have appeared in them disappears, and the subjective symptoms of pregnancy lessen. If the hæmorrhage is internal and the fœtus dead, the patient suffers in the same manner from the retention of the fœtus, but the uterus increases in size. In such cases, there is great difficulty in feeling the fœtal parts; and the uterus, which ordinarily in hæmorrhage is softer than usual, will, if the bleeding is excessive, become tense and hard. Finally, if the membranes have ruptured and saprophytic germs have found their way into the cavity, the fœtus decomposes and a fœtid discharge results.

Accordingly, we may sum up the symptoms as follows:—A varying amount of hæmorrhage, either external or internal; a gradual increase in the size of the uterus, if the fœtus lives and the hæmorrhage is external; a diminution in size, if the fœtus dies and the hæmorrhage is external; a more or less marked and sudden increase, if the hæmorrhage is internal; and a putrid discharge, if the fœtus decomposes.

Diagnosis.—The diagnosis of external hæmorrhage is obvious. The diagnosis of internal hæmorrhage is made by noting the increase in size of the uterus—an increase which enlarges the uterus out of proportion to the period of pregnancy, by the difficulty in feeling the fœtal parts, and by the general condition of the patient. Internal hæmorrhage at this stage of pregnancy is most likely to be confused with vesicular mole, but here a mistake in diagnosis is not of any great importance, as, in either case, the uterus must be emptied. The nature of the discharge will in most cases enable a distinction to be made, as, in hæmorrhage from placental detachment, the discharge is grumous and contains clots; while, in vesicular mole, it is thin and watery and may contain small grape-like cysts.

Treatment.—The treatment of these cases is palliative or active, according to their nature. If the hæmorrhage is slight, and there is no evidence that the fœtus is dead, every effort must be made to check the bleeding by any means short of emptying the uterus. The main factor in attaining this end is absolute rest in bed for at least ten days or a fortnight after the hæmorrhage has ceased.

A mixture containing fifteen minims of Ext. Ergotæ Liq. and five minims of Liq. Strychninæ may be given, as has been recommended in certain cases of threatened abortion.

Active treatment, consisting in the emptying of the uterus, is indicated under the following conditions:—If it is obvious that the patient has lost as much blood as is safe; if the discharge is fœtid; or, if the fœtus is dead.

If the indication for delivery is hæmorrhage alone, and there is no sign of intra-uterine decomposition, the easiest method of emptying the uterus consists in first passing as many sea-tangle tents into the cervix as the latter will hold, after carefully disinfecting the external genitals and vagina, and then in plugging the vagina tightly with iodoform gauze. It is better to use a number of small tents in preference to a couple of large ones, as the dilating effect of the former is superior. The plug and tents are to be removed in twenty-four hours, or sooner if uterine contractions ensue. If there is no appearance of the latter when the tents are removed, it will be well to rupture the membranes, to draw down a foot into the vagina, and either to leave the further expulsion to the uterine contractions, or to complete the delivery of the fœtus. In all cases, if contractions do not follow the rupture of the membranes within four to six hours, it is best to empty the uterus, as there is always a danger of decomposition occurring if we wait too long. An alternative treatment to the use of sea-tangle tents is the plugging of the utero-vaginal canal with iodoform gauze after the method of Dührssen. To do this, the cervix is drawn down by means of an American forceps on both lips, and is dilated with Hegar's dilators as far as possible without laceration. The end of a long strip of iodoform gauze, two inches wide, and either single or double, according to the size of the cervical canal, is passed by means of a sound as far into the uterus as possible. This is followed by the remainder of the strip, and when it is finished, by another similar strip, which is knotted on to the first. Each bit of gauze is passed as high into the uterus as possible, and the maximum amount is introduced. As soon as the cavity is filled, the vagina is plugged tightly. This plug is left *in situ* for twenty-four hours, or until strong labour pains ensue, and is then removed. The advantage of this method is that all hæmorrhage is checked, that intra-uterine decomposition is prevented, and that, even if labour does not follow its removal, it causes sufficient dilatation of the cervix to permit of the easy extraction of the fœtus.

In those cases in which hæmorrhage is complicated by the occurrence of decomposition, the emptying of the uterus must be carried out at one sitting. This is always a more or less troublesome operation, owing to the small size of the cervix, and frequently it will only be possible to extract the child after some proceeding akin to embryotomy. The author has found the following plan to be rapid and comparatively easy, provided that pregnancy has not advanced beyond the early part of the fifth month :—Disinfect the vagina thoroughly, and dilate the cervix as far as possible with Hegar's dilators. Pass one finger into the uterus, seize one, or if possible both feet, and draw them down as far as possible, which will usually be until the breech comes into the cervical canal. As soon as they cannot be drawn down any further, introduce a Schultze's spoon-forceps, or other forceps of a similar shape, into the uterus alongside the breech, and catch the latter and pull it down. This will result in the tearing off of part of it, and then a fresh hold is taken, and so on until the body of the child is extracted piecemeal. The head will be found the most difficult to remove, as it has the largest diameter, but by means of the forceps it can be crushed and so extracted. A Schultze's spoon-forceps is a very safe instrument for this procedure, as, owing to its shape, it has no tendency to catch the uterine walls, while it easily seizes anything which is lying in the cavity. As soon as the fœtus has been entirely removed, the finger is again passed into the uterus and the placenta detached, while counter-pressure is made upon the fundus by the hand placed on the abdominal wall. The uterus is then well douched with creolin lotion (1 in 320), or other antiseptic, and the cavity plugged with iodoform gauze. The latter must be removed in from twelve to twenty-four hours, and the uterus again douched if there is any rise of temperature.

Prognosis.—The prognosis in these cases is good unless the patient has been already much weakened by constant hæmorrhage, or unless she has absorbed an excessive dose of toxins from the decomposed fœtus. To avoid the danger of such an occurrence, the uterus must always be emptied as soon as any of the indications for active treatment, as given above, show themselves.

HÆMORRHAGES OCCURRING DURING THE LAST FOUR MONTHS

Hæmorrhages occurring during the last four months are divided into two great classes :—

I. Accidental hæmorrhage, due to the detachment of a normally situated placenta.

II. Unavoidable hæmorrhage, due to the detachment of a placenta prævia.

ACCIDENTAL HÆMORRHAGE.

Accidental hæmorrhage is the term applied to hæmorrhage due to the detachment of a normally seated placenta—*i.e.*, a placenta no part of which comes into the lower uterine segment.

Frequency.—The frequency of accidental hæmorrhage is very difficult to ascertain, on account of the cursory manner in which the subject is treated in the majority of text-books. At the Rotunda Hospital, amongst 15,109 cases of labour there were 113 cases of accidental hæmorrhage—*i.e.*, one in every 133·7 cases. Almost all these were cases of external accidental hæmorrhage.

Etiology.—The causes of accidental hæmorrhage are akin to the causes of abortion. In former days, they were divided into predisposing and exciting causes, and as the exciting causes were the more obvious, the greater importance was attributed to them. Given the necessary predisposing causes, anything may be an exciting cause which tends to cause a sudden rise in blood-pressure, and so may determine the onset of the hæmorrhage. In the number of such causes may be included a fall, sudden mental emotion, coughing, or any form of abdominal straining, etc. The foregoing are, however, incapable of causing detachment of the placenta when the attachment of the latter to the uterus is normal, and, moreover, cannot be avoided even if the attachment is abnormal. They therefore are of quite secondary importance to the causes which permit such slight incidents to break down the attachment between the placenta and the uterus.

The most frequent cause of detachment of the placenta is to be found in any factor which weakens or breaks down the adhesions between the placenta and the uterine wall. Decidual endometritis is probably the most common of such factors, and, indeed, some authorities—notably Kaltenbach and Veit*—maintain that in all placentæ which separate prematurely there must be serotinal inflammation or degeneration. Renal disease is another common cause, though whether it brings about its effect by giving rise to a decidual endometritis, or whether it causes infarction of the placenta, which infarctions cause detachment and hæmorrhage, is not certain. Winter,† who first drew attention to the association of accidental hæmorrhage and nephritis, found the latter condition and endometritis concomitant. French writers have also been able to trace a very close connection between the two conditions, as in the Clinique Baudelocque albuminuria was present in twenty-four out of thirty-one cases of placental detachment. It is probable that red infarction of the placenta has a close association with nephritis, and that, if extensive, it may be responsible for causing the detachment of the placenta.

Syphilis of the placenta may also give rise to detachment, but it is probably not so common a cause as has been suggested.

Holmes,‡ in an interesting article on accidental hæmorrhage, summarises the causes that he found assigned to the detachment in a hundred and fifty-six collected cases. Of his cases, 80·8 per cent. occurred in multiparæ, 19·2 in primiparæ. Kidney changes were noted in twenty cases, and placental changes in connection with kidney lesions in nine cases. Other placental changes were noted in nineteen cases, of which six were 'apoplexies,' five fatty degeneration, four syphilis and infarcts, two decidual endometritis, one diffuse arteritis, and one chorionic degeneration.

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* Muller's 'Handbuch für Geburt.,' vol. ii , p. 86.

† *Zeitschrift für Geburt. u. Gynäk.*, 1884, vol. xi., p. 356

‡ *American Journ. of Obstet.*, December, 1901, p. 753.

? Traumata of sufficient violence to produce the detachment of the placenta must also be included as causes of accidental hæmorrhage. They may occur as a violent blow, or fall, on the abdomen, or in consequence of forcible traction on the placenta during the expulsion of a fœtus whose cord is too short. Accidental hæmorrhage may also occur in hydramnios, owing to the detachment of the placenta, in consequence of the rapid diminution that occurs in the size of the uterus when the liquor amnii suddenly escapes.

Varieties.—Two chief forms of accidental hæmorrhage are met with, according as the blood escapes externally, or is stored up in the uterus. These are:—

(A) Concealed accidental hæmorrhage.
(B) External accidental hæmorrhage.

These two varieties differ so markedly from one another, as far as the conditions present and the appropriate treatment are concerned, that they must be described separately.

A CONCEALED ACCIDENTAL HÆMORRHAGE.—Concealed accidental hæmorrhage is the term applied to accidental hæmorrhage when the blood is stored up in the uterus instead of escaping into the vagina. In such a condition, the blood may be found in one of four situations:—

(1) Behind the placenta, the whole of which is separated except its edges.
(2) Behind the membranes, which are detached except round the internal os.
(3) In the amniotic cavity.
(4) Behind the presenting part, if the latter fills the lower uterine segment completely.

Concealed accidental hæmorrhage is, with the exception of acute sepsis, the most serious accident which can happen to a pregnant woman. This is due not only to the difficulty of diagnosing its occurrence at an early stage, but also to the fact that we have an entirely different condition of the uterus from that which we find in external hæmorrhage. In concealed hæmorrhage, the blood collects in the uterus, because the latter dilates so easily that the intra-uterine pressure is never sufficiently great to overcome the slight resistance offered to the outflow of blood through the cervix. In external hæmorrhage, quite the opposite is the case. Here, the intra-uterine pressure is so rapidly raised, by the escape of blood from behind the placenta, that such blood is almost immediately forced through the cervix. The cause of the difference in the two cases is, that, in internal hæmorrhage, we have to deal with a uterus the muscle fibre of which has for some reason lost its normal contractile tone, and whose elasticity is, as a result, impaired; while, in external hæmorrhage, the uterine fibre possesses that normal tone, and hence may be described as 'healthy.' It is quite obvious that a ruptured vessel can only bleed into a closed cavity as long as the pressure inside that cavity is less than the blood-pressure. Once the intra-uterine pressure equalises the blood-pressure, the bleeding ceases. If the blood can escape from the cervix as quickly as it flows from behind the placenta, then such equalisation never takes place. If the uterus is healthy in tone, and the outflow of blood from the cervix is prevented, the two pressures rapidly equalise one another, and the bleeding ceases. If, however, the uterine fibre has lost its tone to such an extent that it permits the uterus to dilate before the blood-pressure, then not only does the intra-uterine pressure never rise sufficiently to check the hæmorrhage, but it is not even sufficient to force the blood which has escaped through the cervix. In this manner, concealed hæmorrhage commences. The amount of hæmorrhage which the uterus will permit to accumulate in its cavity depends upon the extent to which the muscle fibre is affected. The first sign that the latter is commencing to react against the distension it is undergoing, is the escape of blood externally, and accordingly the earlier in the hæmorrhage that escape occurs, the healthier may the condition of the uterus be judged to be. These are all important facts to grasp, as they explain the essential differences between external and internal hæmorrhages so far as accompanying conditions go. They also indicate a line of treatment by which external hæmorrhage may be checked, and the necessity for uterine co-operation in carrying out such a treatment.

Symptoms.—The symptoms of concealed hæmorrhage fall under two heads:—

(1) Those due to the loss of blood, and common to all forms of hæmorrhage.

(2) Those due to the accumulation of blood in the uterus.

(1) The symptoms included in the first group do not require any special description here. They will be referred to in full when dealing with post-hæmorrhagic collapse.*

(2) The most prominent symptom in the second group consists in the gradual enlargement of the uterus, which may dilate to such an extent as to fill the entire abdomen and cause pressure on the diaphragm. The uterus at first becomes tense, and then of an almost woody hardness, and is markedly tender to the touch. It is difficult or impossible to palpate the fœtus. At the same time, there is severe abdominal pain, akin to the pain caused by the tonic contraction of the uterus in cases of threatened rupture.

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* *Vide* Part VII., chap vii., Post-partum Hæmorrhage.

Diagnosis.—The diagnosis of concealed hæmorrhage due to detachment of the placenta can be made by means of the symptoms given above. Tenderness of, and increase of size in, the uterus, with ever-increasing pain, are almost pathognomonic of concealed hæmorrhage—an important fact to bear in mind even when there is a sufficient amount of external hæmorrhage to account for any other symptoms.

Treatment.—The treatment of concealed hæmorrhage is so far by no means satisfactory. Mild cases which occur during labour are not very difficult to treat, but severe cases starting prior to the onset of labour are most serious. From what we know of the ætiology of the condition, it is obvious that plugging of the vagina—a line of treatment which is so satisfactory in external hæmorrhage—is here of little avail. In those cases in which we are able to recognise the very commencement of the hæmorrhage, some good may be gained by the application of a tight abdominal binder and possibly by the administration of ergot, while the application of a firm vaginal compress — as will be presently described—may bring on labour before the hæmorrhage has reached a formidable amount. Once the patient begins to have strong uterine contractions, a great deal of the risk of the case disappears. Rupture of the membranes is then indicated, with the object of permitting the blood to escape and the uterus to contract down upon the fœtus. The remaining treatment of the case is the same as that of external accidental hæmorrhage occurring when the patient is in labour. Unfortunately, many cases of concealed hæmorrhage occur before the patient is in labour, and do not admit of any temporising measures. In such cases, the bleeding must be immediately checked, and, in order to do this, the seat of the hæmorrhage must be directly reached. Two lines of treatment present themselves—*accouchement forcé*, and supra-vaginal amputation of the uterus either by Porro's method or not, as may be preferred. These are both most serious measures, and convey *per se* a great element of danger into the case. The only excuse for their adoption is that the danger which they are directed against is so urgent that even the risk of Porro's operation, or *accouchement forcé*, is to be preferred.

a By *accouchement forcé* is meant the dilatation of the cervix, followed by version and the extraction of the fœtus. Dilatation was formerly usually effected by means of radiating incisions through the walls of the cervical canal, or with the fingers. Bossi's dilator, or one of its modifications, now, however, offers a better means of effecting dilatation, and, it may be, will cause a considerable improvement in the rate of mortality in these cases. As soon as the whole hand can be passed into the uterus, the foot of the fœtus is seized and drawn down. By gradually pulling upon the latter, the size of the cervical canal is still further increased, and finally the breech can be brought through.

The remainder of the fœtus is then extracted in the usual manner. If the placenta is not immediately expelled by the uterine contractions, it should be removed by the hand, and in all cases the utero vaginal canal must be plugged firmly with iodoform gauze.

Supra-vaginal amputation of the uterus, if there is sufficient assistance, is quicker than the foregoing, if Porro's operation is performed. There is less blood lost during its performance, and there is but little more shock. The objection to it is the greater number of assistants and the extent of the preparations which it requires. Porro's operation is the most rapid method, but convalescence is slower than if retro-peritoneal treatment of the stump is adopted. In the past, supra-vaginal hysterectomy has perhaps offered the better prospect of saving the life of the patient in serious cases, but we are inclined to think that, in future, dilatation by Bossi's or Frommer's dilator, followed by extraction, will yield better results. It may also be that partial dilatation of the cervical canal in order to give the necessary space, followed by the packing of the uterus tightly with iodoform gauze, may prove successful in checking the hæmorrhage. If it did so, it would materially improve the prognosis, as it would afford the patient time to rally from her state of collapse before expulsion of the fœtus occurred.

Prognosis.—The prognosis for the mother is very serious, especially in those cases which come on before labour starts; for the child it is almost absolutely bad.

External Accidental Hæmorrhage.—External accidental hæmorrhage is the term applied to accidental hæmorrhage when the blood escapes from the uterus according as it is poured out from behind the detached placenta. It is a serious accident, but by no means as serious as is concealed hæmorrhage. In the majority of cases the blood pours into the vagina as rapidly as it escapes from the ruptured vessels. Sometimes, however, a certain amount of blood may first accumulate in the uterus, and then commence to escape externally as soon as the latter reacts against the blood-pressure—*i.e.*, as soon as the intra-uterine pressure becomes sufficiently great to overcome the resistance to the escape of blood.

Symptoms.—The escape of blood from the vagina is the most marked symptom, accompanied by the usual symptoms of collapse if the bleeding continues long enough. In those cases in which there is concealed hæmorrhage as well, the symptoms which have been given under the head of concealed hæmorrhage are also present, though usually to a less degree.

Diagnosis.—The diagnosis of the case has to be made from hæmorrhage due to placenta prævia—*i.e.*, unavoidable hæmorrhage. To do this, examine the patient vaginally, with the object of determining whether the placenta can be felt in the lower uterine segment or not. If it can be felt, it is a case of placenta prævia, if it cannot, of accidental hæmorrhage. In some cases in which the placenta cannot be felt, it may possibly be a case of lateral placenta prævia, but still it is to be treated as if it was one of accidental hæmorrhage. The reason for this is that, if the placenta lies so far from the cervix that it cannot be felt from the vagina, though actually the case may be one of placenta prævia, still the treatment suitable for accidental hæmorrhage will be found to be the more efficacious.

Accidental hæmorrhage may be diagnosed by abdominal palpation by excluding the possibility of placenta prævia. If the head is found to be fixed in the pelvis, the case is certainly not one of placenta prævia.

Treatment.—The treatment of the case, as well as the prognosis, depend to a very great extent upon the time at which the hæmorrhage starts, *i.e.*, whether during pregnancy or labour—when there are no uterine contractions, or when there are. If the patient is in labour, the danger of the case is greatly diminished, and the treatment is comparatively simple. If she is not in labour, the reverse is the case.

If the patient is not in labour when the hæmorrhage starts, there are two points towards which our treatment must be directed. The first is the immediate checking of the hæmorrhage; the second is the induction of labour. If the hæmorrhage can be satisfactorily stopped for the time necessary to bring on uterine contractions, the case is practically reduced to one of hæmorrhage during labour, and the prognosis consequently improved. As has been shown above, there is very little room for blood to accumulate in a 'healthy' uterus filled by an unruptured ovum, and the blood either escapes from the cavity as rapidly as it pours out from behind the placenta, or the intra-uterine pressure becomes equal to the blood-pressure, and the bleeding ceases. Therefore, if the uterus is 'healthy,' and if we prevent the blood which is being poured out from behind the placenta from leaving the uterus, the pressure inside the latter will rapidly become equal to the blood-pressure, and the hæmorrhage will cease. The question then arises, How can we tell whether the uterus is or is not healthy? Clinically, we think, this is answered by the variety of hæmorrhage that has occurred, and that the fact that the hæmorrhage is external shows that the uterus is 'healthy.' The results of cases treated by the vaginal tampons at the Rotunda Hospital supports this belief, as in no case has plugging converted an external into an internal hæmorrhage,—an accident which would surely have occurred if the uterine fibre had lost its tone. The easiest and most effectual method of preventing the escape of blood is by plugging the vagina tightly, and so compressing the cervix. This will check the hæmorrhage, and at the same time it will carry out our other object, which is a necessary part of any successful treatment—namely, it will induce labour. Furthermore, labour thus brought on comes on gradually, and does not cause any aggravation of the shock from which the patient is already suffering, as do the more rapid methods of emptying the uterus. On the contrary, ample time is allowed for the patient to rally from the collapse, which the hæmorrhage has caused, before the uterus empties itself. The plugging is continued until no more can be pressed into the vagina. The patient is then put back to bed, and an abdominal binder pinned as tightly as possible round the uterus, while a T-binder is brought down between the thighs, and also fixed firmly. By this means, the uterus is compressed between the plug in the vagina and the abdominal binder, and the intra-uterine pressure is raised. The plug is left in until strong labour pains ensue, and this usually occurs in from two to four hours. In some cases, the onset of labour is slower than this, and in such the plug must be removed in twenty-four hours for fear of decomposition taking place. If hæmorrhage comes on again it can be replaced, but this is rarely necessary. While the plug is *in situ* the patient must be carefully watched, to see that concealed hæmorrhage is not occurring. The first sign of such a condition is afforded by the patient complaining that the abdominal binder is becoming tighter than she can bear—a condition which is caused by the increase in size of the uterus.

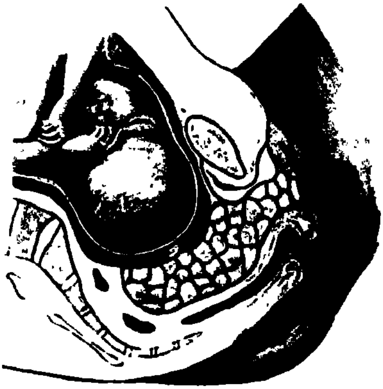

FIG. 296.—DIAGRAM SHOWING VAGINAL TAMPON *in situ*.

The success of this treatment depends upon three points:—the uterus must be 'healthy,' the ovum must be intact, and the plug must be tightly applied.

If the patient is in labour when the hæmorrhage starts, the first thing to be done is to rupture the membranes. This treatment, which was formerly recommended as *the* treatment in all cases, now becomes permissible, as, in consequence of the presence of uterine contraction, it does not tend to lower the intra-uterine pressure. The object of this procedure is to stimulate uterine action and to prevent the detachment of additional portions of the placenta. Every time the uterus contracts, it drives the presenting part or the liquor amnii against the membranes lying over the os internum, and these latter in turn communicate this downward impulse to the placenta. In this manner, with each contraction, while the membranes are unruptured, a fresh piece of placenta is detached. When the membranes are ruptured, the presenting part can advance without causing any such drag upon the placenta. Rupture of the membranes can be accomplished by means of a stilette or the finger-nail, and care must be taken to ensure the gradual escape of the liquor amnii, especially in those cases in which the presenting part is not fixed, lest the cord should be carried down at the same time. In addition to rupturing the membranes, a hot vaginal douche may be given to stimulate uterine contractions, and massage of the fundus, with the same object, may also be tried.

If such treatment fails to check the bleeding, our further plan of action depends upon the size of the os. If the latter is still quite small, the vagina must be plugged as before. This treatment, which would be most unsafe after the membranes are ruptured if there were no labour pains, becomes again safe if there are strong contractions, as the latter ensure the obliteration of any space around the fœtus, left by the escape of the liquor amnii. The plug is left *in situ* until pains of an expulsive character set in, when it may be removed. The use of the plug in cases such as this is, however, very seldom required, as in the large majority of cases hæmorrhage ceases when the membranes are ruptured in the presence of uterine contractions, or else it is possible to empty the uterus. If the os is half or more dilated, and the presenting part is not fixed, podalic version, followed by extraction, is the line of treatment indicated. If, however, the patient is very much collapsed, and all hæmorrhage ceases as soon as a foot has been brought down into the cervical canal, it may be advisable to leave the expulsion of the child to the natural efforts. Version in these cases can usually be carried out by the internal method, but in some cases it may be necessary to adopt the bi-polar method, owing to the small size of the cervical canal. If, on the other hand, the os is fully or almost fully dilated and the head is fixed, immediate extraction by the forceps is indicated.

3 *Other Modes of Treatment.*—The foregoing is the treatment which we recommend, and our reason for so doing will be found below. But, in addition, there are other methods which are recommended by various authorities. Of these the following are the chief:—

Rupture of the Membranes in every case.—Rupture of the membranes in every case is the treatment which formerly had the greatest number of supporters. It is a treatment which is easily carried out, and in some cases is sufficient. If we can be certain that the uterus will contract down upon the fœtus, immediately after the escape of the liquor amnii, there are no very great objections to trying such a course of action, as if it fails it is still possible to resort to plugging. But, if the uterus does not contract down upon the fœtus, there is a large space left inside it for blood to collect in, and as plugging is then contra-indicated, if the hæmorrhage continues, there is nothing left but *accouchement forcé*—the most dangerous of all lines of treatment. Accordingly, rupture of the membranes should only be performed in those cases in which we can be certain that, after it is done, the uterus will contract down upon the fœtus; that is, it should only be performed when the patient is in labour.

Accouchement Forcé.—Accouchement forcé is the most dangerous of all lines of treatment, and is unjustifiable in any case of external hæmorrhage so long as the membranes are intact. The great objection to it lies in the fact that intra-uterine manipulations, particularly the violent manipulations of *accouchement forcé*, tend directly to aggravate the collapse which the hæmorrhage causes.[*]

Prognosis.—The prognosis in external accidental hæmorrhage depends very much on the form of treatment adopted. In the Rotunda Hospital, fifty-six cases of accidental hæmorrhage of all degrees of severity were treated between November, 1889, and November, 1893. *Accouchement forcé* was the mode of treatment adopted in all the serious cases, and of the patients so treated six died. From November, 1893, to November, 1900, fifty-seven cases were treated. *Accouchement forcé* was never performed, its place being entirely taken by plugging. Out of this number one case of external hæmorrhage died, and she had been admitted to the hospital thirty minutes previously with the membranes ruptured. The number of serious cases during the two periods was proportionately the same. The treatment by rupture of the membranes in all cases is credited by its supporters with a mortality of ten to twelve per cent., yet a well-known obstetrician used to consider, that the fact of a student recommending plugging of the vagina as a treatment for accidental hæmorrhage was sufficient ground for depriving him of his examination. The subject is so important that the writer wishes to again state that the advantages of the vaginal plug are as follows:—It at the same time checks hæmorrhage and brings on labour; labour so induced comes on gradually, and before delivery the patient has had an interval of rest, during which she can recover from her collapsed condition; the vaginal plug applied in suitable cases does not tend 'to convert an external into an internal hæmorrhage'; and, even if the bleeding continues after the plug has been applied, the patient is in no worse position for the adoption of any other treatment.

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[*] For the most recent opinions on the treatment of accidental hæmorrhage, see 'Discussion on the Treatment of Accidental Hæmorrhage,' by Sir A. V. Macan, and others (*Brit. Med. Journ.*, October 22, 1904, p. 1049); also Holmes' paper, *Amer. Journ. of Obstet.*, vol. xliv.; and Colclough, *Journ. of Obstet. and Gyn. of the Brit. Empire*, August, 1902.

The fœtal mortality is very high—from 40 to 60 per cent. It will be discussed subsequently.

UNAVOIDABLE HÆMORRHAGE.

Unavoidable hæmorrhage, or hæmorrhage due to placenta prævia, is the term applied to bleeding caused by the detachment of a placenta, any portion of which is implanted so near the os internum, that it becomes separated during the formation of the lower uterine segment.

Frequency.—The statistics relating to the frequency of placenta prævia are very conflicting. Kaltenbach gives the proportion of 1 in 1,500 to 1,600, Winckel 1 in 1,500, Ribemont-Dessaignes 1 in 1,000, the Boston Lying-in Hospital 1 in 239. At the Rotunda Hospital, among 20,000 cases of labour, there were 108 cases of placenta prævia, or 1 in 185.

Ætiology.—The ætiology of placenta prævia is very obscure. It is more frequent amongst multiparæ than amongst primiparæ, and is also relatively more frequent in the case of twin pregnancies. The many theories which have been brought forward may be reduced to two:—

(1) That the ovum is implanted in the uterus at a lower level than is normally the case, and that, consequently, when the placenta is formed, it lies nearer the os internum than is normally the case. Various causes have been suggested to account for the occurrence of such a condition. / Placenta prævia frequently occurs in patients with a history of previous attacks of endometritis, and it has been suggested that the increased size of the uterine cavity in the latter condition allows the ovum, when it leaves the Fallopian tube, to drop into the lower part of the uterus. 2 Webster* brings forward the very plausible suggestion that the low implantation of the ovum may be due to its fertilisation rather later than is usually the case, *i.e.*, after it has reached the lower part of the uterus. When discussing the ætiology of extra-uterine pregnancy, we saw that it was, at least, probable that fertilisation of the ovum might occur at any spot between the ovary and the cervix, but that it usually occurred in the tube. There is, so far as we at present know, no reason that fertilisation should not occur as Webster suggests—when the ovum is in the neighbourhood of the lower uterine segment, but it seems to us that if every such fertilisation resulted in the formation of a placenta prævia, this condition would be much more common than it is. This difficulty can, however, be got over by the equally probable assumption that when such late fertilisation of the ovum occurs the latter is as a rule carried out of the uterus before it has

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* 'A Text-Book of Obstetrics,' 1903, p. 342.

time to become implanted in the mucous membrane, and that it is only in the rare cases in which, for some cause or other, the ovum is not carried out of the uterus that implantation in the lower segment results. Webster and others possess specimens of early pregnancies which clearly show a primary implantation of the ovum near the os internum.

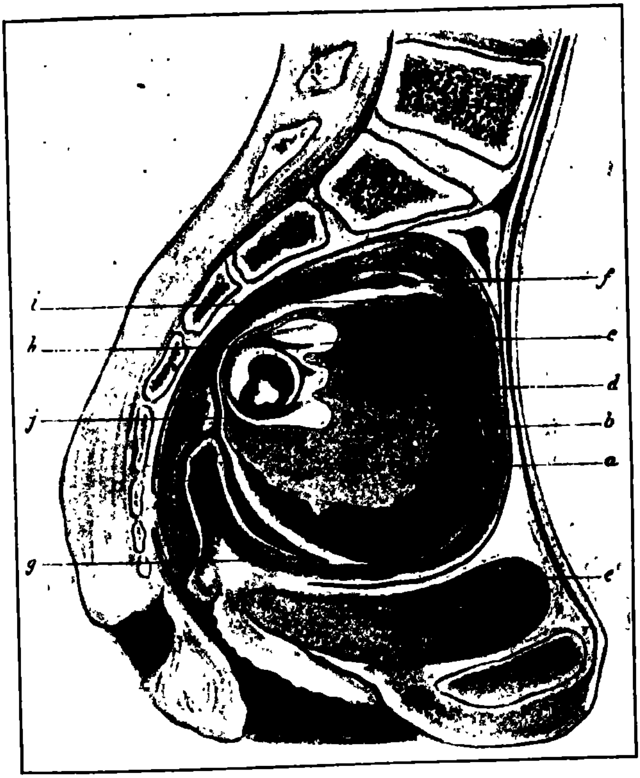

FIG. 297.—A SAGITTAL SECTION OF THE UTERUS AT END OF THIRD MONTH OF PREGNANCY, SHOWING REFLEXAL PLACENTA

A considerable portion of the decidua reflexa is covered by the placenta, which extends in the anterior part of the uterus as low as the os internum.

a, Uterine wall, to which the serotinal placenta is attached; *b*, amniotic cavity; *c*, fœtus; *d*, serotinal placenta; *e*, urine in bladder; *f*, space between decidua vera and decidua reflexa; *g*, junction of reflexa and serotina on anterior wall of uterus; *h*, decidua reflexa free from placenta; *i*, placenta developed on posterior part of decidua reflexa; *j*, os internum. (Webster.)

(2) That the placenta is developed out of chorionic villi which are implanted in the decidua reflexa as well as out of those

which are implanted in the normal manner in the decidua serotina, or that, in other words, there is a reflexal placenta as well as a serotinal placenta. This theory was advanced by Hofmeier* in 1888, and supported by Kaltenbach† in 1890, and has been abundantly verified by specimens showing a reflexal placenta. It probably accounts for the occurrence of most cases of placenta prævia.

The exciting cause of hæmorrhage from a placenta prævia was for a long time held to be the gradual increase in size of the placental site, the result of the formation and expansion of the lower uterine segment. It is, however, now usually agreed that the lower uterine segment does not alter until labour sets in, and, therefore, this explanation can only be accepted in cases in which hæmorrhage commences with the onset of labour. For those cases in which hæmorrhage starts earlier in pregnancy, another explanation must be found. Webster regards it as probable that in every case in which the placenta is partly reflexal in origin, there is a tendency all through pregnancy for degeneration of the reflexal portion to occur, with consequent rupture from thinning of its substance. He thinks that many cases of abortion are due to such a condition, and that the firmer the union between the reflexal placenta and the decidua vera, the later in pregnancy will separation occur. If, on the other hand, the low situation of the placenta is due, not to its reflexal origin, but to a primarily low implantation of the ovum, hæmorrhage is less likely to occur until the onset of labour, whether this occurs at full term or prematurely. We thus see that hæmorrhage in placenta prævia may be started in one of several ways:—1 In the case of a reflexal placenta, it is probably due to degenerative changes in, and excessive thinning of, the reflexal portion, due to the increase in size of the ovum. In such cases, the hæmorrhage usually commences during pregnancy, or, if the union between the reflexal placenta and the decidua vera is very dense, it may not occur until full term. 2 In the case of a low implantation of the ovum, the placenta being entirely serotinal, hæmorrhage as a rule is started by the commencing dilatation of the cervix and the formation of the lower uterine segment, and so is coincident with the onset of labour. As a rule, in such cases the hæmorrhage does not occur until full term, but sometimes it may occur earlier as a result of the onset of premature labour. 3 Lastly, a placenta prævia may be detached in consequence of the action of causes similar to those which bring about the detachment of a normally seated placenta.

4 In some cases, hæmorrhage may be due to the laceration in the so-called circular sinus (Meckel) of the placenta—that is, in the outer ring of intervillous spaces which surround the placenta. The 'sinus' may be torn even in cases in which the placenta is

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* *Verh. d. deutschen Gesell. f. Gyn.*, 1888, 159-163; and 1897, 204.

† *Zeitschr. für Geb. u. Gyn.*, 1890, xviii., 1-7.

normally seated, but it is naturally more exposed to injury during labour, when the edge of the placenta passes across the uterine orifice.

Varieties.—A placenta prævia is termed central, marginal, or lateral, according as it completely covers the os, just reaches its edge, or merely extends into the lower uterine segment without reaching the inner os. It is obvious that these relationships will materially alter according to the size of the os. Thus, what may be a central placenta prævia at the commencement of labour, will as the os dilates become marginal, and so it is necessary for the sake of clearness to specify the size of the os at the time at which the examination is made. It is usual to use these terms in connection with an undilated condition of the cervical canal.

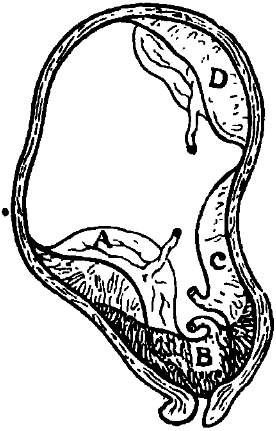

FIG. 298.—DIAGRAM SHOWING DIFFERENT SITUATIONS OF THE PLACENTA. A, Marginal placenta prævia, B, central placenta prævia, C, lateral placenta prævia, D, normal situation of placenta

Symptoms.—The chief symptom is the occurrence of an attack of hæmorrhage, coming on without any apparent cause, and of more or less severity. The first attack of hæmorrhage, if not treated, may be sufficiently profuse to cause the death of the patient, but such an occurrence is very rare. More commonly she recovers from it, only to have a second attack in from eight to ten days, and this in turn is followed by others. The hæmorrhage of placenta prævia is, essentially, a hæmorrhage of repetitions (Ribemont-Dessaignes). As in accidental hæmorrhage, the bleeding is most severe during a contraction of the uterus. This, in placenta prævia, is due to the fact that the vessels which supply the placenta lie below the contraction ring, and consequently during a contraction not only are they not compressed, but the blood-pressure in them is increased, owing to the obstruction offered to the flow of blood in branches running above the contraction ring. 3 If the bleeding continues, the usual symptoms of collapse appear.

Diagnosis.—1 There is only one reliable method of diagnosing a placenta prævia—that is, by feeling it through the cervical canal, or, if that is closed, through the lateral fornices. 2 In almost all cases in which the occurrence of hæmorrhage calls our attention to the condition, the cervix will be found to be sufficiently dilated to admit one or two fingers, and so there is rarely any difficulty in determining the position of the placenta. The latter is felt as a spongy mass, either completely covering over the os internum or lying to one or other side of it. A blood-clot, which has become adherent to the membranes in either of these situations, is most prone to be confounded with it. A distinction can be made by noting the ready manner in which a clot can be broken up by the pressure of the fingers, while a portion of placenta cannot. 4 If the cervical canal is closed, the placenta can be felt as a thick and soft mass lying between the uterine wall and the presenting part at one or other side. The cervix and the lower

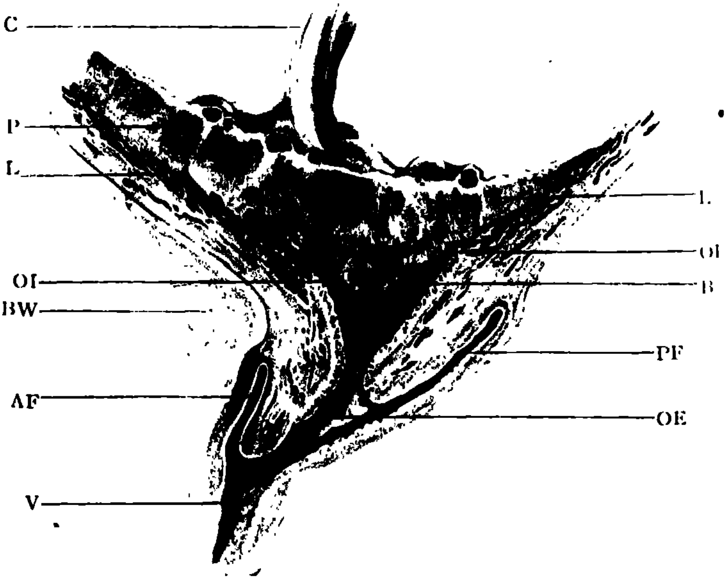

FIG. 299—CENTRAL PLACENTA PRÆVIA

C, Cord; P, placenta; L, line of separation of placenta; OI, os internum; B, blood-clot attached to placenta; PF, posterior vaginal fornix; AF, anterior vaginal fornix; OE, os externum; V, vagina; BW, portion of wall of bladder. (Bumm.)

uterine segment are also softer than normal, and the vessels of the lateral fornix are enlarged and pulsate more strongly than normal. If the placenta cannot be felt, the case is to be treated as one of accidental hæmorrhage.

A placenta prævia may also be sometimes diagnosed by abdominal palpation. This can be done by noticing that there is something which either displaces the presenting part to one or other side of the false pelvis, or prevents it from descending

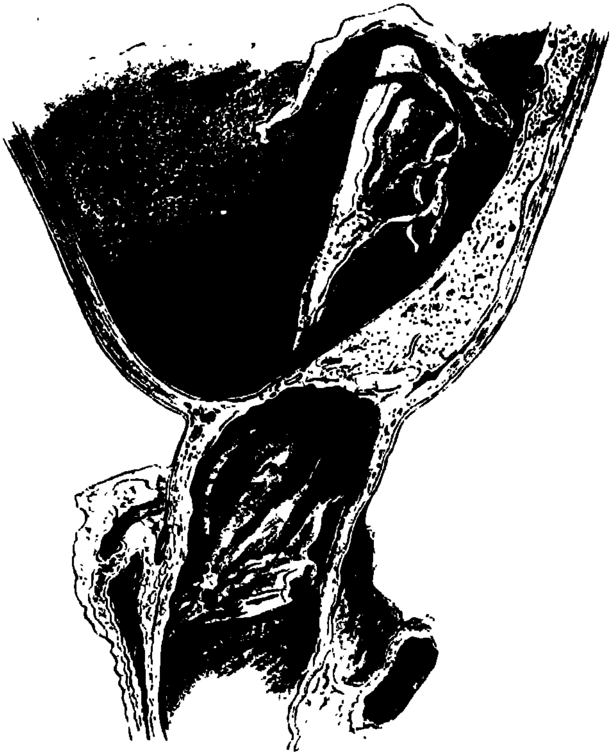

FIG. 300.—A MARGINAL PLACENTA PRÆVIA. (Ahlfeld.)

through the brim. Then, on very careful palpation, a soft mass may be felt at the side from which the presenting part has been displaced. If the presenting part is fixed in the brim, it is almost certain that the case is not one of placenta prævia.

Treatment.—The first point to recognise with regard to the treatment of placenta prævia is that, immediately the condition is diagnosed, steps must be taken with a view to ending the pregnancy, whether the bleeding has temporarily ceased or not.

The only exception which may be made to this rule, is in those cases in which the patient is in such circumstances that, if the bleeding restarts, she can be immediately treated. Many cases have been lost because, on the arrival of the medical man, the bleeding was found to have ceased, and so treatment was not adopted, with the result that the bleeding recurred with fatal consequences.

As in accidental hæmorrhage, the line of treatment to be adopted depends to a very great extent upon whether the patient is in labour or not. If she is in labour, the treatment of the case is comparatively simple, both because uterine contractions are present, and also because the fact that hæmorrhage did not occur until the patient came into labour, shows that the placenta is not very close to the os.

Again, as in accidental hæmorrhage, the objects of our treatment are to check the bleeding and to bring on labour gradually. These objects are best attained by the method introduced by Braxton Hicks.* This consists in turning the child by podalic version into a breech presentation, in rupturing the membranes, and in drawing down a foot. The remainder of the expulsion of the fœtus is then left to Nature. The result of this treatment is that the hæmorrhage is checked by the pressure of the breech and subsequently of the body of the child upon the placenta, while the rupture of the membranes and the partial extraction of the fœtus ensure the onset of labour. If there is any return of the bleeding, a little traction on the foot will drag down more of the breech, and so increase the pressure upon the placenta. If, as may happen in very rare cases, labour pains do not come on within twelve hours, or if, before that time —the fœtus being dead—signs of decomposition set in, delivery must be accomplished by means of gentle traction upon the foot. The method of performing bi-polar version, which the author prefers, differs somewhat from the more classical method of Braxton Hicks, and will be described in its proper place.

In order that this line of treatment may be carried out satisfactorily, two conditions must be fulfilled:—

(1) The cervical canal must be of sufficient size to admit at least two fingers. If the hæmorrhage is at all severe, this condition is practically always fulfilled.

(2) The membranes must be intact, or only quite recently ruptured. If the uterus has become contracted down upon the fœtus it will be found impossible to turn except by internal version, and there is rarely or never sufficient cervical dilatation to allow of this. This condition will also be always fulfilled unless an ignorant attendant has ruptured the membranes.

In the rare cases in which the cervical canal is not sufficiently dilated to admit two fingers, and in which the hæmorrhage is so severe that it is impossible to wait for a short time to allow it to dilate, the firm plugging of the vagina with iodoform gauze and cotton-wool is indicated, as in accidental hæmorrhage.

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* 'The Treatment of Placenta Prævia,' *Medical Press and Circular*, September 9, 1885, p. 223; and *Brit Med. Journ.*, November 30, 1889, p. 1205.

When the patient is in labour, the treatment of the case is the same as that of accidental hæmorrhage occurring under the same conditions. a Commence by rupturing the membranes, a proceeding which is usually sufficient. This acts by allowing the head to advance without causing traction through the membranes upon the placenta, and at the same time the descending head presses upon the placenta and checks hæmorrhage, as does the breech after version has been performed. If this is not sufficient to check the bleeding, internal version may be performed, followed or not by extraction, according to the patient's condition and the size of the os. If the head is fixed and the os sufficiently dilated, the forceps may be applied.

Other Modes of Treatment.—The foregoing is the treatment which we consider most suitable. Other lines of treatment have been recommended by various authorities, and of these the following are the chief:—

(1) Champetier de Ribes' Bag.—The plugging of the lower uterine segment by means of a Champetier de Ribes' bag is perhaps the line of treatment which, after bi-polar version, has the greatest number of advocates at the present day. A Champetier de Ribes' bag is a pear-shaped bag made of waterproofed silk. Its wide end or base is three and a half inches across, while the narrow end tapers to join a half-inch rubber tube, with which it is continuous, and by which it is filled. The manner in which the bag is introduced will be subsequently described. Care must be taken that it lies completely above the placenta. In order that it may press against the latter with the necessary force, it is connected with the foot of the bed by means of an elastic cord, which is made as tight as the patient can bear. The effect of the introduction into the amniotic cavity of a pear-shaped bag, like that of Champetier de Ribes, is to cause a compression of the placenta against the uterine wall, and at the same time a dilatation of the cervical canal, in very much the same manner as the breech of the child does in Braxton Hicks' method; while the rupture of the membranes also helps to bring on uterine contractions. The bag is allowed to remain in the uterus as long as it will—that is, until the cervical canal is so dilated that it slips out. b If this does not happen within twelve hours the bag must be removed, the child turned by bi-polar or internal version, according to the size of the os, and extracted immediately or not, according to the condition of the patient. The average time which the bag takes to dilate the cervix is said to be five hours and ten minutes (Blacker). c In the case of a central placenta prævia, the bag must be introduced through an opening in the placenta made over the inner os.

The advantages claimed for this course of procedure over

Braxton Hicks' method are the ease with which it can be carried out, and the improved fœtal prognosis. While fully recognising it as a perfectly scientific mode of treatment, and one which gives excellent results, the writer considers it to be inferior, for general use, to version. In careless hands it is more liable to cause sepsis, inasmuch as a possibly non-sterile foreign body is lying for some hours in the uterus; and its performance, which may not be required very frequently, necessitates the use of a special apparatus, and one, moreover, which is very liable to be destroyed by keeping.

(2) *Accouchement Forcé.*—The adoption of *accouchement forcé* is even more dangerous in the case of placenta prævia than it is in the case of accidental hæmorrhage, owing to the softened and vascular condition of the cervix, and the consequent risk of laceration. It is essential to remember that in these cases no attempt may be made to deliver the fœtus through an incompletely dilated os.

(3) Plugging of the Vagina.—Plugging of the vagina is an objectionable and unnecessary course of procedure in placenta prævia. There is always some risk of sepsis following the use of a plug, and this risk is very much increased in those cases in which the placenta is situated in the lower uterine segment, as the inoculation of the placental site by the extension of vaginal infection is so easy. Further, we have an excellent and safe mode of treating these cases which we do not possess in the case of accidental hæmorrhage, viz., version. Accordingly, the use of the plug should be limited to the small proportion of cases in which it is absolutely necessary, viz., to those cases in which the patient is bleeding, and in which the cervical canal is not sufficiently dilated to admit even two fingers.

(4) Partial Detachment of the Placenta.—Detachment of the placenta from the lower uterine segment is the main feature of the treatment recommended by Barnes.* The steps of his procedure, in his own words, are as follows:—

'(*a*) Rupture the membranes; this disposes the uterus to contract.

'(*b*) Apply a firm bandage over the abdomen.

'(*c*) A tampon may be introduced to gain time, but it is not necessary to do so. Watch; observe with vigilance.

'(*d*) Detach all the placenta adhering within the inferior zone, and always watch. If there is no hæmorrhage, wait a little. The uterus may perhaps do what is necessary. If this fails, dilate the cervix with the hydrostatic dilator. Wait and watch. If the natural forces fail, employ the forceps, which gives the best chance to the child, or, as a last resort, perform version.

'(*e*) Avoid as far as possible everything that predisposes to septicæmia.'

Barnes' treatment has now but very few supporters. At the ime at which it was introduced it was a considerable advance over the methods in use, inasmuch as it prevented the rapid emptying of the uterus. It is, however, very much inferior to either Braxton Hicks' method or to the use of Champetier de Ribes' bag. It is a very tedious course of procedure for the patient, and one which affords many opportunities of inoculating her with septic organisms. In placenta prævia, more than in any other condition, the number of vaginal examinations must be brought down as near the irreducible minimum as possible, on account of the ease of infecting the placental site. But Barnes' method demands repeated examinations in order to carry out its multiple steps, and to ensure that the necessary 'vigilance' is being used.

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* 'Obstetric Operations.'

Complications.—Although the main danger caused by placenta prævia is death from hæmorrhage coming from the placental site, there are still other grave risks sufficiently imminent to require careful consideration during the treatment of a case. Of these the following are the chief:—

(1) Laceration of the Cervix.—As has been already mentioned, laceration of the cervix is very prone to occur in these cases, owing to the softened condition of the cervix resulting from its increased blood-supply. Further, for the same reason, lacerations are most dangerous, as, if any of the large vessels going to the placenta are torn across, fatal traumatic hæmorrhage will very probably result. It is this which in these cases makes *accouchement forcé* so dangerous a proceeding, and which furnishes a direct contra-indication to the extraction of the child through an incompletely dilated cervix. If post-partum hæmorrhage occurs, the possibility of its being due to a cervical laceration must always be borne in mind.

(2) Septic Infection.—In consequence of the proximity of the placental site to the vagina, the absorption of septic organisms, or of ptomaines, may very easily take place. Such absorption may occur not only during labour, but also during the puerperium. Accordingly, as has been already said, vaginal examinations must be avoided as far as possible during labour, and any appearance of sapræmic change in the vaginal contents after confinement must be immediately treated.

(3) Post-partum Hæmorrhage.—Post-partum hæmorrhage in cases of placenta prævia is a comparatively common occurrence. Its frequency is due to three factors:—

(*a*) Laceration of the Cervix.—This has been already noted.

(*b*) The Situation of the Placental Site.—When a large portion of the placenta extends below the contraction ring, the placental site cannot be affected to the same extent by the subsequent contraction and retraction of the uterine muscle as if the placenta was entirely situated in the contractile part of the uterus. As a result, the lumen of the placental vessels may not be completely obliterated.

(*c*) The Debilitating Effect of Previous Hæmorrhage upon the Patient.—Marked anæmia and debility, the results of previous hæmorrhages, have frequently a very prejudicial effect upon the uterine contractions.

Prognosis.—The prognosis in placenta prævia depends greatly upon the treatment adopted. The maternal mortality is said to vary between two and forty per cent. Galabin had ninety-two cases, with eight deaths; Winckel, nineteen cases, with one death; Dührssen, fifty cases, with two deaths. Blacker has collected twenty-two cases, in which the Champetier de Ribes' bag was used, with one death. At the Rotunda Hospital, where Braxton Hicks' method is used in all severe cases, 108 cases were treated from November, 1889, to November, 1903, with three deaths. Of these deaths, one was due to rupture of the uterus occurring in a case in which the forceps was applied. A second was due to hæmorrhage, the patient being admitted moribund after a journey of five miles in an open cart. The third died of sapræmia, from which the patient was suffering when admitted. As in accidental hæmorrhage, the fœtal mortality is very high—from 40 to 60 per cent.

Fœtal Mortality in Accidental and Unavoidable Hæmorrhage.—A few words must be said with regard to the fœtal mortality in these cases. It has been found by experience that, in ante-partum hæmorrhage, the life of the child is more or less antagonistic to the life of the mother, and that any treatment which will give the lowest maternal mortality will give the highest fœtal mortality, and *vice versâ*. *Accouchement forcé*, which in the past gave a maternal mortality of from 40 to 60 per cent., gave a considerably lower fœtal mortality than does the treatment which is adopted at the present day. So far, no treatment has been described which materially reduces the fœtal mortality, while affording the same excellent maternal results that are obtained by Braxton Hicks' treatment in placenta prævia, or by vaginal plugging in accidental hæmorrhage. This condition of affairs is, after all, what must be expected. So far as we can see at present, it is necessary to give the mother as much time as possible to recover from the hæmorrhage which has occurred, before the uterus is emptied either naturally or artificially. During this time, the supply of oxygen to the fœtus is limited to that amount which can come through a placenta, of which not only a large portion is detached, but of which the remainder is undergoing a more or less forcible compression against the uterine wall. If this compression can obliterate the vessels which are torn across, it must also to some extent diminish the size of the lumen of those which are intact. Furthermore, even if the fœtus is delivered alive, its expectation of life is extremely bad. It is frequently premature, and has always suffered more or less from deprivation of oxygen. As a result, such infants very frequently die during the first month after birth. It may frequently appear, in cases of placenta prævia, as if slight traction upon the leg of the child would save its life by hastening its delivery, and the very natural desire to save both lives may induce us to do so. In some cases, where the condition of the mother is good and the cervix is sufficiently dilated to remove the danger of laceration, it may be possible to hasten delivery without increasing the maternal danger to an unjustifiable extent. On the other hand, if the case is one which should have been left to Nature—as the majority are, we may find that we have sacrificed the life of the mother for the sake of an infant who succumbs shortly after its birth.

HÆMORRHAGES OCCURRING INDEPENDENTLY OF PREGNANCY

I MENSTRUATION.

The possibility of menstruation occurring during pregnancy is a question which apparently has not been definitely answered. In answering it, much depends upon the meaning we attach to the word 'menstruation.' If the latter is understood to mean merely a periodical discharge, there is apparently no reason why it should not occur. Undoubtedly, the uterus undergoes some form of stimulation, even during pregnancy, at what would have been menstrual periods if the patient had not been pregnant. Under such circumstances, it is not very difficult to believe that the attendant congestion may cause a slight hæmorrhagic discharge from an ulcerated cervix, a polypus, or even from the inflamed decidua vera covering the lower pole of the uterus before this membrane has come into contact with the decidua reflexa — that is, before the third month. If, however, we more correctly limit the term to the physiological discharge which accompanies the monthly destruction and expulsion of the uterine endometrium, it is obviously impossible that menstruation could take place during pregnancy without causing abortion. Cases of supposed menstruation during pregnancy can almost invariably be accounted for by some pathological condition of the uterus or cervix. The regular recurrence of a monthly discharge during the entire period of pregnancy almost invariably points to the existence of a double uterus. Pajot said that, while the hæmorrhagic discharges which occur during pregnancy may have some characters which cause them to resemble menstruation, they invariably differ from the latter in their duration, and in the quantity and quality of the blood. Pinard stated that a case of the persistence of menstruation in a pregnant woman had never yet been observed. Dakin considers that, 'while one monthly bleeding may be allowed to pass as a menstruation in the absence of any discoverable cause, or of any further disturbance, any repetition of this should always be looked upon as a threatening of abortion, and the patient treated on this assumption.'

American writers, on the other hand, do not regard the persistence of menstruation as so improbable or impossible. Lusk considered that the occurrence of pregnancy is not incompatible with the existence of a periodical flow—to which, however, he is careful not to apply the term 'menstruation.' Parvin stated that a monthly flow may occur once or oftener during pregnancy, or even recur during the whole period. While Palmer of Ohio records the case of a patient of his own who never menstruated except when she was pregnant!

The general attitude of modern obstetricians, in the case of patients who consider themselves to be pregnant while they are still menstruating, may be summed up in the words of Stoltz:—'Rarely will one be deceived who regards a woman menstruating regularly, with all the characters of menstruation, as not pregnant; while trusting the contrary opinion, he is exposed to frequent errors.'

2 Hæmorrhage from Tumours.

1 Myomata of the uterus often cause sterility, and consequently are not a very frequent complication of pregnancy. Intra-uterine myomata may, during pregnancy or labour, give rise to accidental hæmorrhage by causing the detachment of the placenta, owing to the irregularity their presence imparts to the uterine contractions. Subsequent to delivery, they are a very common cause of post-partum hæmorrhage. Myomata of the cervix, or pedunculated myomata of the uterus which project into the vagina, may give rise to constant small hæmorrhages during pregnancy, and have been found as the cause of periodical discharges which have simulated menstruation.

2 Malignant disease of the cervix or vagina usually causes a more or less continuous hæmorrhagic, and perhaps sanious, discharge during the whole of pregnancy. It will also favour the occurrence of abortion owing to the anæmia and cachexia it induces.

3 Other tumours or pathological conditions, whose existence may give rise to slight hæmorrhage coming from the vagina or its neighbourhood during pregnancy, are a urethral caruncle, b mucous polypi of the cervix, and c hæmorrhoids.

3 Hæmorrhage from Traumatisms.

Traumatisms in the region of the vagina and vulva may cause a varying degree of hæmorrhage, according to the nature of the lesion, but considerably more interesting than the immediate effect of such injuries is the question of the result of a traumatism, either surgical or otherwise, upon the pregnancy. So far, the most varying consequences have been met with. In some women, a very severe accident or surgical operation has been attended by no bad effects upon the pregnancy. In other women, the slightest accident or interference has been followed by the immediate emptying of the uterus. Guéniot's conclusions on this subject are as follows:—

(1) The harm wrought by traumatism occurring during pregnancy is not governed by any absolute law.

(2) If the woman is without morbid predisposition—she, her uterus, and the ovum healthy, a traumatism is generally without injurious effect upon the pregnancy.

(3) If gestation is complicated by a pathological condition, such as abnormal irritability of the uterus, disease or great size of the ovum, albuminuria, etc., the traumatism, however slight, and whatever the part involved, may frequently cause the premature expulsion of the ovum.

(4) Great caution is necessary in performing surgical operations during pregnancy.

Ribemont-Dessaignes* considers that accidental traumata vary in their effects, according to their intensity, their site, the amount of hæmorrhage which accompanies them, and the occurrence of wound complication, sepsis, etc. As regards surgical intervention, Verneuil says:—'Surgical intervention is not forbidden during pregnancy, but is under the guidance of a definite rule—to abstain from it when it is possible to do so; to intervene when it is necessary.'

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* 'Précis d'Obstétrique,' 3rd edition, p. 690.

PART VII

THE PATHOLOGY OF LABOUR

CHAPTER I

ANOMALIES OF THE EXPELLING FORCES

Precipitate Labour—Ætiology—Symptoms—Treatment. Uterine Inertia—Primary Inertia—Secondary Inertia. Spasmodic and Irregular Uterine Contractions—Spasmodic Contraction of the Body—Spasmodic Contraction of the Cervix.

The uterine contractions of labour may present three variations from the normal:—They may be too strong in proportion to the resistance offered to the descent of the fœtus; they may be too weak; or they may be abnormal in their mode of occurrence. Accordingly, we shall consider the anomalies of the expelling forces under three heads:—

I. Precipitate labour.
II. Uterine inertia.
III. Continuous and irregular uterine contractions.

PRECIPITATE LABOUR

Precipitate labour is the term applied to the too rapid expulsion of the fœtus.

Ætiology.—The cause of precipitate labour, stated in general terms, is a disproportion between the strength of the uterine contractions and the resistance offered to the descent of the fœtus. Accordingly, excessively strong uterine contractions, a small fœtus, or an easily dilatable parturient canal, may cause its occurrence. The cause of abnormally strong uterine contractions is obscure. It may be found in an undue development of the uterine muscle fibres, in an unusually excitable condition of the uterine nerve centres, or in the application of unusually strong stimuli to these centres. Excessive muscular development of the uterus may account for those cases of hereditary tendency to precipitate labour, which have been recorded from time to time. An unusually irritable condition of the nerve endings may be the result of previous inflammatory conditions of the uterus. Unusually strong stimulation of the nerve centres may occur in certain mental conditions, such as extreme fright, or may be the result of some substance which acts as an oxytocic. Excess of CO_2 in the blood normally acts as a stimulus to uterine action, and, if the excess is considerable, the action of the uterus may be proportionately stronger than normal. Cases of maternal asphyxia have been recorded, in which death must have occurred rapidly, but in which delivery apparently took place during the period of asphyxia, a fact which points to the occurrence of unusually strong uterine contractions. In acute infectious diseases, precipitate labour also occurs, and here, again, some toxic condition of the blood may furnish the additional stimulus.

According to Winckel,* the chief predisposing causes of precipitate labour are to be found in multiple pregnancy, diseased condition of the patient (syphilis, bronchitis, epilepsy), small size and maceration of the fœtus, and shortness of the umbilical cord.

Symptoms.—When precipitate labour is due to unduly strong uterine contractions, the latter may follow one another so rapidly as to be almost continuous. They may be present from the commencement of labour, or may not occur until towards the end of the first stage. If the birth canal is dilatable, the fœtus is rapidly expelled, and may be shot out some little distance from the vulvar orifice. In such cases, the cord may be torn, or even detachment of the placenta may result from the sudden drag upon it. Such accidents are especially liable to occur, if the patient happens to be in a standing position when delivery takes place. If the birth canal is not easily dilatable, extreme degrees of laceration of the cervix, vagina, or perinæum may readily result. Another complication is post-partum hæmorrhage, due, in all probability, to the fact that, owing to the short duration of labour, the normal degree of retraction of the uterine fibre has not occurred, and that, consequently, the usual mechanism by which hæmorrhage is checked fails.

Treatment.—It will be seen from the foregoing that precipitate labour is by no means free from danger, so far as the mother and the fœtus are concerned. The principal danger to the former consists in laceration of the parturient canal and in post-partum hæmorrhage, and to the latter in its birth when the mother is in an unsuitable position, with perhaps consequent rupture of the cord and umbilical hæmorrhage. Unfortunately, however, our knowledge of the occurrence of precipitate labour is usually *post facto*, and only serves to warn us of what may happen on a subsequent occasion. If a patient is known to be the subject of too rapid labours, she must lie down as soon as the warning symptoms of labour occur, and must not be allowed to get up, especially for the purpose of going to stool, as accidents have frequently occurred in this way. If the medical attendant is present, chloroform should be administered as soon as the contractions become unduly violent. The third stage should never be hastened, as incomplete retraction of the uterine muscle is usually present.

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* *Op. cit.*, p. 517.

UTERINE INERTIA.

Uterine inertia is the term applied to the occurrence of weak labour pains. It may occur as a primary condition, present from the commencement of labour, or as a secondary condition, which does not occur until the end of the first or during the second stage. As primary inertia differs from secondary inertia, both in its causes and treatment, we shall discuss the two conditions separately.

PRIMARY UTERINE INERTIA.—Primary uterine inertia, as has been mentioned, is present from the beginning of labour, and the uterus never contracts with the normal strength. It is a rarer condition than secondary uterine inertia, as will be understood when its ætiology is taken into consideration.

Ætiology.—Primary inertia is usually due to faulty development of the uterus, resulting in imperfect muscular development;2 to changes in the uterine tissue, the result of disease or of too frequent pregnancies;3 to faulty uterine innervation;4 or to a debilitated condition of the patient. In uterus unicornis, or bicornis, in uterus septa, and in persistence of an infantile type of uterus, muscular development is, as a rule, incomplete, and, consequently, the muscular force necessary to provide contractions of the required strength is lacking. The same condition may also result in consequence of the presence of tumours of the uterus such as myomata, or from alterations in the muscle fibre, the result of inflammation or overdistension. Faulty innervation of the uterus must be a very rare occurrence, and when present would most probably result in missed labour. Primary inertia, the result of a debilitated condition of the patient, may occur after severe ante-partum hæmorrhages, chlorosis, anæmia, phthisis, and such conditions.

Symptoms.—The symptoms of primary inertia are obvious, and are present from the commencement of labour. The intervals between the contractions are prolonged, the contractions themselves are short, and cause but slight hardening of the uterus and a correspondingly slight degree of pain. Dilatation of the cervix proceeds slowly and is often incomplete, and the second and third stages are similarly prolonged. In the third stage, severe hæmorrhage may follow the detachment of the placenta. The condition of the patient is at first unaffected by the delay, as, owing to the absence of strong contractions, there is no undue pressure upon the soft parts. In some cases, the pains may pass off completely, and a condition of missed labour result. In other cases, however, the contractions may be sufficiently strong to drive the head into the pelvis, and its prolonged presence there may cause severe compression of the soft parts, with resultant cramp-like pains and swelling and œdema of the legs and vulva. The temperature rises in consequence of decomposition of the liquor amnii in the vagina, and there is a corresponding rise in the rate of the pulse. The patient becomes restless and weak, and death results if she is allowed to remain undelivered. During the puerperium, fistulæ may form between the bladder or rectum and the vagina, in consequence of sloughing of the tissues from the prolonged pressure.

Diagnosis.—The diagnosis of primary inertia is made from the foregoing symptoms, and especially by noting that the consistency of the uterus changes but slightly during a pain. The rate of advance of the presenting part is not a reliable sign, as it may be retarded from many causes other than inertia.

Treatment.—It is important to distinguish between primary and secondary inertia, owing to the difference in the treatment of the two conditions. In secondary inertia, it frequently is possible to cause a return of the contractions by the adoption of suitable treatment, while in true primary inertia it rarely is possible to stimulate contractions. It is always advisable to wait for contractions, if there is any prospect of their occurring, as they lessen the risk of post-partum hæmorrhage. If, however, there is no prospect of such return, there is nothing to be gained by allowing the patient to remain undelivered. For these reasons, the treatment of primary inertia consists in stimulating, as far as possible, the contractions that are present, and in supplementing them by assistance. In some cases, the strength of the contractions may be increased by massage of the uterus, by hot vaginal douches, and by stimulating food. If the cervix does not dilate, dilatation must be obtained by the use of hydrostatic or other dilators, or by incision, as may be thought best. As soon as the necessary degree of dilatation has been obtained, the membranes must be ruptured. This may have the effect of stimulating the contractions, and, if so, the patient may be given an opportunity of delivering herself naturally. If, however, the contractions do not increase in strength, there is little to be gained by waiting, and delivery must be brought about by artificial means. In some cases, this may be accomplished by expression of the fœtus by Kristeller's method.* If this fails, and the head is still free above the brim, version and extraction may be performed, or, if the head is fixed, the forceps may be applied.

If contractions do not recur after the expulsion of the fœtus, a similar course must be adopted, and the artificial removal of the after-birth carried out. Here, again, expression is first tried, and if this fails, the placenta must be removed manually. In such cases, the danger of post-partum hæmorrhage is very great, and the operator must be thoroughly prepared for its occurrence. It is well to commence by giving a full dose of ergot by the mouth or hypodermically, and then a hot uterine douche as soon as the placenta has been removed. In all cases, the necessary implements and materials for tamponing the cavity of the uterus must be at hand.

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* *Berliner Klin. Wochenschrift*, 1867, No. 6; *Monatss. für Geburts.*, vol. xxix., p. 237.

Prognosis. — The presence of primary uterine inertia very materially increases the dangers of parturition both for the mother and the fœtus. If the former is allowed to remain too long undelivered, serious lesions may result from the prolonged pressure of the head on the pelvic soft parts, and sapræmic intoxication may result from decomposition of the liquor amnii, while in extreme cases death may occur from exhaustion. Delivery itself is often difficult in consequence of the incomplete dilatation of the cervix, and lacerations of the latter may result, while the non-contraction and retraction of the uterine muscle, during the third stage of labour, may cause profuse and fatal post-partum hæmorrhage. So far as the fœtus is concerned, there is no great increase of danger so long as the head remains above the brim, as there is but slight pressure upon it. Prolonged delay after the head has passed into the pelvis will, however, result in the death of the fœtus, as there is necessarily some interference with the circulation. Further, artificial delivery, no matter how carefully carried out, is always accompanied by a somewhat higher rate of fœtal mortality, than is spontaneous delivery. This is particularly the case when version and extraction have to be performed in order to effect the delivery of the fœtus.

SECONDARY UTERINE INERTIA.—Secondary uterine inertia is the term applied to inertia which occurs after the patient has been in labour for some time. The contractions of the uterus may have been of full strength at the commencement of labour, or even of greater strength than usual, but then gradually become weaker or in some cases cease altogether. Secondary uterine inertia is a more common occurrence than is primary inertia.

Ætiology.—Any of the conditions which have been mentioned as a cause of primary inertia may also, if less marked, cause secondary inertia, as they may so affect the uterine muscle that it may be capable of contracting normally for a certain time, but then may not be strong enough to continue so contracting, with the result that a condition of inertia supervenes. In addition to these causes, any factor which tends to offer an obstruction to the birth of the fœtus may also produce exhaustion of the uterine muscle, and so be a cause of secondary inertia. Such obstruction may occur in any of the following conditions:—

(1) Abnormalities of the fœtus as regards presentation, position, or size.

(2) Want of correlation between the axis of the uterus and that of the pelvic brim, as a result of which the fœtal head is driven against the pelvic bones, instead of into the cavity.

(3) Pelvic contraction.

(4) Tumours or stenosis of the maternal soft parts.

(5) Overdistension of any of the pelvic viscera.

Another cause of secondary inertia, and one which belongs to a different class, is to be found in failure of the auxiliary forces of labour—that is to say, failure of the contractions of the abdominal and other voluntary muscles. This may be the result of deficient development of, or failure to exert, these muscles.

Symptoms.—The symptoms of secondary inertia are identical with those of primary inertia, save that they appear some time after labour has started, and are not present from the commencement, as in the primary form. In many cases, the contractions of the uterus may have been exceptionally strong during the early part of labour, and then gradually become weaker or perhaps die away altogether. If the patient obtains the needed rest, the contractions will in some cases return in their normal strength and labour terminate naturally.

Diagnosis.—Secondary uterine inertia can only be confused with one condition—that known as tonic contraction of the uterus. In this, the contractions, instead of being intermittent, are continuous, and there is no period of relaxation. Herman* insists on the importance of distinguishing between these two conditions, and on the danger that exists of confusing them. Both usually occur after labour has been unduly prolonged, and in both the normal recurrence of uterine contractions has ceased. Here, however, the similarity stops. In secondary inertia, the condition of the patient is good, her aspect is one of rest, she is not suffering pain, and her pulse, temperature, and respiration are at first unaffected. In tetanus of the uterus, on the other hand, her aspect is anxious, her pulse is rapid, increasing in frequency, and small, and the rate of her respiration is increased. On palpation of the abdomen, in inertia, the uterus is found to be flaccid, the fœtal parts can readily be felt, and there is no marked tenderness; in tetanus, the uterus is hard, the fœtal parts are scarcely perceptible, and the patient cries out with pain on the uterus being touched. On vaginal examination, in inertia, there is little or no caput succedaneum on the presenting part unless the contractions have previously been severe, and the part can be pushed upwards if it has not descended into the pelvic cavity; in tetanus, there is usually a large caput, and the presenting part, even if still free at the brim, can only be pushed upwards if considerable force is used.

Treatment.—The treatment of secondary inertia differs materially from that of the primary form. The reason for this has been mentioned. In the primary form, there is practically no hope of normal contractions occurring, and, consequently, the indication is to help the existing contractions to deliver the fœtus. In the secondary form, on the other hand, the uterus is frequently only in a condition of temporary exhaustion, and, if a period of rest is given to the tired muscle, contractions of the necessary strength will return, and delivery be effected by the natural efforts. Accordingly, the indication for treatment in the latter form is to give the patient an interval of as complete rest as possible, and at the same time to remove any obstacle that may be in the way of the birth of the child, and, when the period of rest is over, to endeavour to stimulate the uterine contractions as much as possible.

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* 'Difficult Labour,' p. 127.

Accordingly, in secondary inertia we commence by determining, if possible, the cause. If an obstacle to delivery is discovered, we try to remove it. In this connection, the condition of the bladder and rectum must be particularly ascertained, as distension of these viscera is one of the commonest causes of inertia. If they are full, they must be emptied in the usual manner. If there are any deviations of the uterus, which destroy the correlation between the uterine and pelvic axes, they must be corrected by the application of a binder and of pads so placed as to push the uterus into its proper position and to keep it there. Other, and more serious, obstacles to delivery must be suitably treated, and if possible removed.

If the inertia still continues, the next step consists in administering an opiate, to make the patient sleep. As we desire this to act quickly, some preparation of opium or its alkaloids is the most suitable, and either Tr. Opii (♏ 30 to ♏ 40), or morphia (gr. ¼ to ½), may be given. This will, in all probability, give the patient a couple of hours' sleep, and when she awakes the contractions will return, or, if they do not do so at once, they may often be induced by administering a hot vaginal douche, and by massage of the uterine walls. If, in spite of our efforts, contractions cannot be provoked, the fœtus must be expressed or extracted by forceps, as in primary inertia.

Prognosis.—The prognosis for both mother and infant is not at all so serious in secondary as in primary inertia. The contractions are usually stronger in the former variety, and, even if they are not sufficiently strong to expel the fœtus, they return after its delivery in sufficient force to expel the placenta and to prevent post-partum hæmorrhage. Further, as secondary inertia usually occurs during the second stage of labour, there is not the same difficulty in delivering the fœtus as there is when inertia commences prior to the dilatation of the uterine orifice.

SPASMODIC AND IRREGULAR UTERINE CONTRACTIONS

Spasmodic contraction was the term applied by Winckel to any contraction of the uterus which was abnormally painful, or faulty as regards its direction, duration, or effect. Two separate conditions are included under this term:—Spasmodic contraction of the body of the uterus; and spasmodic contraction of the cervix.

SPASMODIC CONTRACTION OF THE BODY.—Spasmodic contraction of the body of the uterus may show itself by the occurrence of contractions, which are more violent, more painful, and more irregular in their onset than is normal. It may occur as an intermittent or clonic spasm, or as a continuous spasm, the so-called tetanus uteri. Clonic contractions may occur in groups, several very rapidly following one another, and then ceasing for a longer interval. In tetanus uteri, the normal intermittent contractions are replaced by a state of continuous contraction, and a persistent condition of the uterine muscle is produced similar to that found at the acme of a contraction.

Ætiology.—Intermittent or clonic spasm sometimes occurs in a uterus which is the subject of inflammatory conditions, such as endo-cervicitis or old-standing gonorrhœal endometritis. Sometimes, such a spasm represents an extra effort on the part of the uterus to overcome some obstruction to the expulsion of the fœtus. Occasionally, it is due to mechanical irritation of the uterus, by too frequent vaginal examinations, by prolonged intra-uterine manipulations as in the performance of version, or possibly by too forcible massage of the uterine wall.

Tetanic or tonic spasm of the uterus is most frequently the result of an obstruction to the expulsion of the fœtus. It may also result from the administration of oxytocics, particularly ergot.

Symptoms.—The symptoms of intermittent and of continuous spasm are very similar. The principal symptoms are due to the strength and persistence of the contraction. The uterus during the spasm is tense, hard, and tender, so that it is difficult or impossible to palpate the fœtal parts. The pain caused by the contraction is very great, and causes the patient to cry out and to resist any efforts which may be made to examine her either abdominally or vaginally. The rate of respiration and of the pulse increases, and if labour is delayed the temperature rises. Frequent vomiting is also a common accompaniment. If the condition is allowed to persist, the pressure on the pelvic nerves and bloodvessels leads to the occurrence of cramps in the legs, and swelling, particularly in the region of the vulva. On making a vaginal examination, the presenting part is usually found to be firmly wedged in the pelvis, and a large caput succedaneum has formed. The persistence of tonic spasm tends to bring about the death of the fœtus, as it interferes with the placental circulation.

Diagnosis.—The diagnosis of clonic spasm of the uterus can readily be made. The contractions are more violent, cause more pain, occur at irregular intervals, and are associated with more constitutional disturbance than is normal.

Tonic contraction of the uterus has to be distinguished from secondary uterine inertia. The points of distinction have been already pointed out, and if we remember that it is possible to confuse the two conditions, it is not difficult to distinguish between them.

Treatment.—The prophylactic treatment of spasmodic contraction consists in removing any obstruction to the birth of the fœtus, and in avoiding unnecessary vaginal examinations and the use of oxytocics. If clonic spasms occur, they may be relieved in the first stage by the internal administration of chloral in 20-grain doses, or morphia hypodermically—¼ to ½ grain dose. The chloral may be repeated every three or four hours, but not more than three doses should be administered. Considerable relief may also be given by placing the patient in a hot bath, and allowing her to remain there for from ten to twenty minutes. Care must, however, be taken to be sure that there is no risk of the infant being expelled during this time, and that assistance is at hand in case it is required. Hot vaginal douches delivered at a low pressure will also sometimes give relief. If these measures are unavailing, chloroform must be administered during the spasms.

The treatment of tonic contraction is similar, save that delivery should be at once effected under chloroform if the condition of the cervix permits the application of forceps. If the cervix is not sufficiently dilated to enable this course to be adopted, the various measures enumerated above may be tried, unless the other symptoms of the patient point to the necessity for immediate delivery. In such a case, the cervix must be incised or dilated, and the forceps then applied. Such cases are, however, very rare, unless a spasmodic condition of the circular fibres of the uterine orifice is associated with spasm of the body. This class of case will be referred to in a following paragraph.

Prognosis.—All forms of spasmodic contraction of the uterus are detrimental to the fœtus, in proportion to the duration of the spasm, as they interfere with the free circulation of maternal blood in the placental sinuses. In tonic contraction, the fœtal prognosis is especially bad, and the death of the fœtus will usually result unless its early delivery is effected. The maternal prognosis depends upon the duration of labour. If the patient is allowed to remain undelivered for too long a period after tonic contraction has set in, there is danger of rupture of the thinned lower uterine segment, as retraction proceeds steadily all the time. The persistence of the spasm during the third stage is also a serious matter, as it leads to the retention of the placenta and renders its artificial removal difficult.

Spasmodic Contraction of the Cervix.—Spasmodic contraction of the circular fibres of the cervix may occur during any stage of labour, with the result that the expulsion of the fœtus or of the placenta, as the case may be, is prevented. The terms 'trismus uteri' and 'stricture of the uterus' are also applied to this condition. A similar contraction of the circular fibres of the body of the uterus may also occur, with the result that the uterine cavity is divided into two parts by an hour-glass constriction at the level of the contracted fibres.

Ætiology.—The two principal causes of spasmodic contraction of the cervix are previous inflammatory conditions of that part, and mechanical irritation during labour. Premature rupture of the membranes may also help to cause spasm, as the direct pressure of the presenting part may irritate the undilated cervical tissues. Cervical spasm is also said to be not uncommonly associated with placenta prævia, but our own experience does not support such a statement.

Symptoms.—The most prominent symptom consists in delay in the dilatation of the cervix. On examination *per vaginam*, the edges of the cervix are found to be thin and tense, and any attempt at dilatation gives rise to extreme pain. The remaining symptoms are dependent upon the obstruction to the descent of the presenting part, and are those of delayed labour. If spasmodic contraction of the cervix occurs during the third stage, it causes retention of the placenta. In such cases, the contraction usually occurs, not at the level of the cervix, but in the neighbourhood of the retraction ring. It may be associated with profuse hæmorrhage, as the retention of the placenta after its detachment prevents the proper retraction of the uterine muscle.

Diagnosis.—The diagnosis of spasmodic contraction of the cervix is made by noting the tense and sensitive condition of the cervical tissues. They feel to the examining finger like an overstretched rubber ring, with sharp or string-like edges.

Treatment.—Spasmodic contraction of the cervix is a most unpleasant condition with which to meet, but, fortunately, it is of comparatively rare occurrence. In the past, under the name of 'rigid os,' it used to be the bugbear of the obstetrician, and particularly of the too conscientious obstetrician, as the more vaginal examinations he made, the greater the proportion of cases of 'rigid os' that occurred in his practice. Now, when it is understood that many vaginal examinations are not only unnecessary but dangerous, 'rigid os,' or spasmodic contraction of the cervix, is a condition of extreme rarity, and if it occurs is usually due to some structural alteration in the cervix. In such cases, relaxation may be obtained by the administration of hot vaginal douches, and of sedatives, such as chloral, given either by the mouth or in a rectal injection. If there is no immediate indication for terminating labour, we should wait as long as possible, since in many cases the spasm will pass off. If it does not do so, and the condition of the patient or the fœtus necessitates the extraction of the latter, the cervix must be dilated or incised. Dilatation by hydrostatic dilators, or Frömmer's dilator, is the more suitable method to adopt in a multipara, as will be understood if the mechanism of cervical dilatation in such a case is remembered. In the case of a primipara, in whom the edges of the uterine orifice are thin, multiple incisions are easily carried out, and are more satisfactory. When spasmodic contraction occurs during the third stage, it may pass off if all friction of the uterus is stopped. If it does not do so, the administration of a little chloroform may be effectual. If it becomes necessary to remove the placenta, dilatation of the stricture may be effected by passing the fingers, in the shape of a wedge, gently and gradually through the orifice. Much force must not be employed, as sometimes it is easier to tear the uterus than to dilate the stricture.

Prognosis.—The prognosis both for mother and fœtus in cases of spasmodic contraction of the cervix depends upon the time during which the spasm persists. If it does not relax, rupture of the uterus may result, owing to the obstruction offered to the descent of the fœtus, and death of the fœtus from the long-continued pressure to which it is subjected. Spasmodic contraction during the third stage may result in serious post-partum hæmorrhage.

CHAPTER II

CONTRACTED PELVIS

Contracted Pelvis—Classification—Frequency—Diagnosis—Pelvimetry—Symptoms, during pregnancy, during labour—Treatment—Prognosis.

The pelvis is said to be contracted when any of its diameters are shorter than normal. All the diameters of the pelvis may be so affected, or only certain diameters at certain levels. Thus, any one diameter, or all the diameters of the brim, of the cavity, and of the outlet may be diminished in length, or the diminution may involve one or more of these different levels, without affecting the others.

Classification.—Although the importance of contraction of the pelvis as a cause of obstruction during labour has been recognised for some hundreds of years, it is only within a comparatively recent period that the frequency of its occurrence has been realised, and that attempts have been made to classify the various types of deformity in accordance with the changes that are actually present in the pelvis. Many authors have employed a classification depending upon the ætiology and pathology of the various deformities met with, and scientifically such is without doubt the more correct, but, from the point of view of treatment, it is far more important to group together those pelves in which a similar change of form is present, irrespective of the cause or pathology of the individual varieties. The following classification will therefore be adopted:—

I. Generally contracted pelvis.
  (1) Generally contracted pelvis.
    (*a*) Non-rachitic. [illegible]
    (*b*) Rachitic.
  (2) Dwarf pelvis.

II. Flattened pelvis.
  (1) Flat pelvis.
    (*a*) Non-rachitic.
    (*b*) Rachitic. [illegible]

- (2) Generally contracted flat pelvis.
    - (*a*) Non-rachitic.
    - (*b*) Rachitic.
- (3) Pelvis of congenital dislocation of the hips.

III. OBLIQUELY DISTORTED PELVIS.

- (1) By spinal curvature—kypho-scoliotic pelvis.
- (2) By imperfect or abolished use of one lower limb—coxalgic pelvis.
- (3) By asymmetry of the sacrum—unilateral synostotic pelvis.

IV. TRANSVERSELY CONTRACTED PELVIS.

- (1) The bilateral synostotic pelvis, or Robert's pelvis.
- (2) The kyphotic pelvis.

V. FUNNEL-SHAPED PELVIS.

VI. COMPRESSED OR TRI-RADIATE PELVIS.

- (1) The rachitic tri-radiate pelvis.
- (2) The osteo malacic tri-radiate pelvis.

VII. SPONDYLOLISTHETIC PELVIS.

VIII. PELVIS NARROWED BY FRACTURES, EXOSTOSES, OR OTHER FORM OF TUMOUR.

IX. SPLIT PELVIS.

For convenience of description, obstetricians are accustomed to divide symmetrical contractions into four degrees, according to the length of the true conjugate. The limits of each degree differ in the case of flattened and of generally contracted pelvis, as the disproportion between the head and the pelvis is naturally greater when transverse narrowing is associated with antero-posterior narrowing. Accordingly, as the following table shows, the limits of the degrees in generally contracted pelvis are a centimetre, or, roughly, a quarter of an inch, more than in flattened pelvis:—

Degrees.	Length of Conjugate in Flat Pelvis.	Length of Conjugate in Generally Contracted Pelvis.
1st	4 to 3¼ ins. (10 to 8·25 cms. approx.)	4 to 3½ ins. (10 to 9 cms. approx.)
2nd	3¼ to 2¾ ins. (8·25 to 7 cms approx.)	3½ to 3 ins. (9 to 7·5 cms. approx.)
3rd	2¾ to 2¼ ins. (7 to 5·5 cms. approx.)	3 to 2½ ins. (7·5 to 6·5 cms. approx.)
4th	below 2¼ ins. (5·75 cms. approx.)	below 2½ ins. (6·5 cms. approx.)

Frequency.—The frequency of contracted pelvis, in either private or hospital practice in these countries, is very difficult to determine. In the first place, the proportion of cases varies greatly in different localities. In the second place, even in maternity hospitals, many cases of minor degrees of contraction are not diagnosed, and, as statistics are not as carefully kept as they might be, it is difficult to obtain any very accurate information from them. The statistics compiled by Winckel* are very complete, but they refer to a country in which the proportion of cases of contracted pelvis is much higher than it is in these countries. This authority makes the statement that 'contraction of the pelvis is present in from 10 to 15 per cent. of all parturient women, but that usually only 5 per cent. are recognised even in clinical institutions on account of their effect on labour.' His actual figures show that at Dresden, out of 10,679 cases, 356 had contracted pelvis, or 2·8 per cent., and that of these cases, 41 per cent. required artificial assistance. It may be useful to compare with these the figures of the Rotunda Hospital, as they probably furnish one of the most reliable means of determining the relative frequency of contraction in these countries. The statistics from 1889 to 1903 show that out of 20,000 cases, 113 had contracted pelvis, or 0·56 per cent. As there is a little uncertainty attending the exact figures for three of these years, it is probable that about one per cent. is the true proportion.

The relative frequency with which the different varieties of contracted pelvis are met, according to Winckel's figures, is as follows:—

Flattened pelvis occurred in	95·25	per cent. of cases of deformity.
Obliquely contracted pelvis in	2·38	,, ,,
Generally contracted pelvis in	1·42	,, ,,
Spondylolisthetic pelvis in	0·47	,, ,,
Transversely contracted at outlet in	0·24	,, ,,
Osteomalacic	0·24	,, ,,

The various forms of contracted pelvis may be divided into two groups, according to the relative frequency with which they are met:—

(1) The common forms of contracted pelvis.—The forms of contracted pelvis, which can be regarded as of relatively common occurrence in these countries, are all included in the two classes—generally contracted pelvis, and flattened pelvis. The commonest form of all is the rachitic flat pelvis.

(2) The rarer forms of contracted pelvis.—In this group are included all the other classes which have been enumerated, and also the generally contracted rachitic pelvis, the dwarf pelvis, the generally contracted and flat non-rachitic pelvis, and the pelvis of congenital dislocation of the hips, all of which are included in the classes of generally contracted and of flattened pelvis.

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* *Op. cit.*, p. 461.

THE DIAGNOSIS OF CONTRACTED PELVIS.

A provisional diagnosis of contracted pelvis is made from the appearance, history, and symptoms of the patients, and is confirmed by means of pelvimetry, by which also the exact form and degree of contraction present is ascertained.

History.—The chief points on which information should be obtained are the childhood of the patient and her previous labours. As regards her childhood, the occurrence of rickets must be carefully looked for. Evidence of such an occurrence is to be found in a history of late dentition, inability to walk at the usual age, or temporary loss of the power of walking. According to one writer,* the history is of no value in the diagnosis of past rickets, first because the patient usually knows nothing of her childhood, and secondly because, even if obtained, the history affords no information of value in the treatment of the case. This is scarcely quite correct. A negative history is naturally of no value, and even a positive history of ability to walk at the proper time may be valueless. On the other hand, a positive history of inability to walk is of considerable value, not in showing the proper treatment to adopt, but in indicating the necessity for examining the patient carefully, and perhaps of performing pelvimetry with a view to ascertaining the exact condition of the pelvis.

The history of previous labours affords more definite information. If the patient has been normally confined at term of a normally sized infant, it is positive proof that she has not a contracted pelvis. If, on the other hand, there is a history of previous difficult labours — prolonged labour, difficult forceps cases, or craniotomy—the probability of a contracted pelvis is very great. A history which is very suggestive of a slight degree of pelvic contraction is as follows:—The first labour is very tedious, delivery being finally effected by the forceps, the fœtus perhaps being dead. The second labour is also tedious, but perhaps ends naturally. The third labour is still more tedious and ends in the performance of craniotomy; the fourth also ends in craniotomy. A history of the birth of several dead children, which were alive at the commencement of labour, is also very suggestive of pelvic deformity.

The presence of one of the rarer forms of pelvic deformity is suggested by a history of osteomalacia, hip or spinal disease, or fracture of the pelvis.

Appearance.—Any of the following conditions suggest pelvic deformity:—

(1) Very small stature.

(2) Pendulous abdomen.

(3) Curvature of the spine—kyphosis, lordosis, or scoliosis, especially when affecting the lumbar region.

(4) Crooked legs, legs of unequal length, or absence of one leg; and prominence of or impaired mobility in one hip.

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* Herman.

Abdominal and Vaginal Examination.—Abdominal palpation and vaginal examination afford most important information, both during pregnancy and labour. Abdominal palpation informs us of the relation of the presenting part to the brim of the pelvis. If the head presents and is fixed, we know for certain that we are not dealing with a case of contraction of the brim, and as this is the commonest site of contraction, it is probable that there is no contraction present. On the other hand, if the head is felt high above the brim and is movable at a time at which it ought to be fixed—*i.e.*, during the last few weeks of pregnancy in primiparæ and shortly after the commencement of labour in multiparæ, it is extremely probable that there is some degree of pelvic contraction. Several other conditions, however, also cause non-fixation, so that this condition must not be regarded as a certain proof of contraction.

Vaginal examination may at once reveal the presence of pelvic contraction, as in cases of marked contraction of the outlet, or when we find a low promontory within easy reach of the finger, or an exostosis springing from the pelvic bones. A more careful examination of the sides of the pelvis may reveal flattening of one or both sides in an obliquely distorted pelvis, in Robert's pelvis, or in general contraction of the brim. During labour, information is obtained by abdominal palpation from the non-fixation and high situation of the presenting part, and by vaginal examination from the undue protrusion of the membranes into the vagina during a contraction of the uterus.

Pelvimetry.—The foregoing modes of making a diagnosis only enable us to suspect the existence of a contracted pelvis, or at most to determine in a general way that there is actually some contraction, but they will not tell us either the degree or the form of contraction present. Accordingly, in all cases in which pelvic narrowing is suspected, we must resort to pelvimetry to obtain definite information on these important points. The various methods of measuring the pelvis have been already described in full, and here we shall only deal with the deductions that can be drawn from the results of our measurement.

The following distances are measured by external pelvimetry:—

(1) The distance between the anterior superior iliac spines.

(2) The distance between the most distant portions of the iliac crests.

(3) The external conjugate, and the transverse and the antero-posterior diameters of the outlet.

(4) The distance between the posterior superior iliac spines.

(5) The distance between the trochanters.

From these measurements, we can get some information as to the existence and nature of the contraction present, but little or none as to the degree, save in the case of the measurements of the diameters of the outlet. The information that is obtained may be stated as follows:—

(1) The external conjugate normally measures about 8 inches. If in any case it is found to be less than 6¼ inches, there is certainly some degree of antero-posterior narrowing present.

(2) The normal distance between the anterior superior spines of the ilia is 10½ inches, and between the crests 11½ inches. If there is considerable shortening of these distances, there is probably some contraction present. According to Herman,* however, the inter-spinous distance may vary between 9 and 13 inches, and the inter-cristal between 10 and 14 inches, without much alteration in the dimensions of the true pelvis.

(3) The normal ratio of the distance between the spines and the distance between the crests is as 10½ to 11½. If the former distance is either equal to, or greater than, the latter, we are dealing with a case of rachitic pelvis, as in this form of contraction the anterior extremities of the iliac crests are flared outwards.

(4) The normal ratio of the distance between the posterior superior spines of the ilia and the distance between the anterior superior spines is as 1 is to 3, or as 1 to 3½. If the former distance is increased in proportion to the latter, so that the ratio become less than 1 to 3, it points to the presence of a generally contracted pelvis, as in this form of contraction the promontory is high, and the posterior spines are not pulled inwards as much as is usually the case. If, on the other hand, the distance between the posterior superior spines is diminished, so that the ratio becomes greater than 1 to 3, it points to the presence of a flat pelvis, in which the promontory is low, and sunk downwards and inwards between the iliac bones.

(5) The measurements of the transverse and of the antero-posterior diameters of the outlet give the actual size of the outlet.

By internal pelvimetry, we ascertain the actual length of the true conjugate and of the transverse diameter of the brim, and, consequently, the actual size of the latter. From these measurements, and from the measurement of the antero-posterior and the transverse diameters of the outlet, we learn the nature and the degree of the contraction present. The information obtained may be stated as follows:—

(1) If both the conjugate and the transverse diameters of the brim are diminished, but still preserve their normal ratio to each other, we are dealing with a case of generally contracted pelvis. In such cases, it is probable that there is also some narrowing of the outlet.

(2) If the conjugate diameter alone is diminished, we are dealing with a case of flat pelvis.

(3) If both conjugate and transverse diameters are diminished, but the conjugate is diminished out of proportion to the transverse, we are dealing with a case of generally contracted and flat pelvis.

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* *Op. cit.*, p. 168.

(4) If the transverse diameter is much diminished and the conjugate increased, we are dealing with a case of Robert's pelvis.

(5) If the transverse diameter of the outlet is much diminished and there is a marked increase in the conjugate of the brim, we are dealing with a kyphotic pelvis.

(6) If both antero-posterior and transverse diameters of the outlet are much diminished, without any noteworthy increase in the diameters of the brim, we are dealing with a funnel-shaped pelvis.

Those varieties of contraction, which are associated with marked deformity of the pelvis, are distinguished by the obvious changes which occur in the shape of the pelvis, as in the case of the compressed, spondylolisthetic, and transversely contracted pelves.

THE SYMPTOMS OF CONTRACTED PELVIS.

The effects of a contracted pelvis are manifest not alone during parturition, but also during pregnancy, and so it is better to discuss the symptoms under two heads—during pregnancy, and during labour.

The Symptoms of Contracted Pelvis during Pregnancy.—The principal effect of contraction of the pelvis during pregnancy is on the position of the uterus. During the early months of pregnancy, backward displacement of the uterus may occur, and has been already described. In most cases, this displacement corrects itself of its own accord, as pregnancy advances, but if—as in certain cases of contracted pelvis—the promontory projects somewhat over the brim, the uterus may become caught below it and be unable to ascend, and thus an incarcerated pregnant retroverted uterus may result. If incarceration does not occur, or if it has been corrected, then, in the later months of pregnancy the narrow brim tends to push the enlarged uterus upwards, and so to make it occupy a higher position in the abdomen than is usually the case. In consequence of this, and also of the lack of the usual support that the pelvic brim affords, the uterus tends to fall forwards against the abdominal wall, and to gradually cause by its weight an overdistension of the integuments and fascia. As this relaxation occurs, the uterus falls more and more forward, and finally in extreme cases comes into a position of complete anteversion, in which the fundus lies at the same or at even a lower level than the cervix. This condition is known as a pendulous abdomen.

Another effect of contracted pelvis is to cause mal-presentations, due partly to the loss of the usual support that the presenting vertex receives from the pelvic brim, and partly to the anteverted position of the uterus. For similar reasons, frequent changes occur in the presenting part during pregnancy.

The following table shows the relative frequency of the different presentations as found by Spiegelberg* in 680 cases of contracted pelvis, and side by side with his figures are placed for the sake of comparison the usual percentage of the presentations:—

Presentation.	Percentage in Contracted Pelvis.	Percentage in all Cases.
Vertex	84·3	95·53
Pelvic	4·8	3·11
Face	2·6	0·6
Brow	0·9	0·2
Shoulder	7·4	0·56

The Symptoms of Contracted Pelvis during Labour.—The effects of contracted pelvis are naturally more manifest and more important during labour than during pregnancy. It will be convenient to discuss them under the following heads:—

(1) Effect on the relation of the head to the brim.
(2) Effect on the fœtus.
(3) Effect on the mechanism of expulsion.
(4) Effect on the uterus and vagina.
(5) Post-partum effects.

(1) The Effect on the Relation of the Head to the Brim.—The altered relation between the size of the brim and the size of the fœtal head in contracted pelvis has been already mentioned, as have been the results that occur during pregnancy from this altered relation. In addition to these results, other consequences follow during labour. First, and most important, even in slight degrees of contraction, the head does not fix as early in labour as is usual, while, in the greater degrees, fixation may never occur. In the latter case, the uterine contractions increase in strength and endeavour to force the head through the brim, and, failing in this, either die away completely—a condition of missed labour ensuing, or continue until rupture of the thinned lower uterine segment results. Secondly, the presenting head is prevented from descending and filling the lower uterine segment, and the various consequences of its non-descent follow. These have been already referred to in another place, and need only be enumerated here. The membranes protrude unduly into the vagina as a conical or sausage-shaped swelling, early rupture occurs, the liquor amnii escapes suddenly and completely, and the cord may be swept down. A remoter consequence due to the loss of the dilating action of the unruptured bag of membranes consists in the slow dilatation of the uterine orifice. In some cases, the latter may dilate in the usual manner at the commencement of labour, as long as the membranes remain intact, but on their rupture dilatation ceases, or perhaps the cervix actually closes, to be again dilated by the

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* *Op. cit.*, vol. ii., p. 59.

presenting part as it descends. This is a tedious process, and materially increases the length of labour.

(2) The Effect on the Fœtus.—Some of the effects of contracted pelvis on the fœtus have been already mentioned. Mal-presentations are common, and prolapse of the cord tends to occur. In consequence of the early rupture of the membranes and the complete escape of the liquor amnii, the full force of the uterine contractions is directly exerted upon the fœtus, and, in consequence, the latter is subjected to a pressure which, if continued for sufficient time, causes its death. Next to the death of the fœtus from long-continued compression, the most important effects of pelvic contraction are to be found in the changes which take place in the fœtal head, in consequence of the manner in which it is compressed by the contracted brim.

The compression of the head by the narrow brim leads to considerable deformity. In consequence of the length of labour and the strength of the uterine contractions, the caput succedaneum is considerably larger than in normal cases. It is limited at first to the part of the head which is below the dilating rim of the external os, but later as labour advances it covers all that part of the head that lies below the girdle of pelvic contact. Occasionally, two distinct swellings may be found after delivery, one corresponding to the pressure of the cervical tissues, the other to the pressure of the pelvic bones (Herman). Another consequence of compression is the excessive moulding of the cranial bones that occurs in cases in which the disproportion between the head and pelvis is considerable, but is insufficient to prevent the head from traversing the brim. At first, there is merely an exaggeration of the normal process of moulding, but as this exaggeration becomes more marked, laceration of the intracranial sinuses may occur, with accompanying hæmorrhage. In extreme cases, fracture of the cranial bones may result. The particular shape which the head takes as a result of this moulding depends on the particular variety of contracted pelvis, and will be discussed in another place.

A third consequence of compression is the formation of pressure marks on the skin and cranial bones. Whenever the head is driven against or forcibly past any projection on the pelvic wall, the skin will be excoriated and perhaps cut by the projection, and there may be a corresponding dinting of the subjacent cranial bones. As a rule, the promontory furnishes the projection, but, more rarely, it may consist of an exostosis on the back of the symphysis pubis or elsewhere. The marking caused by the promontory differs according to the particular variety of contracted pelvis, and to the mechanism by which the head passes the brim, and accordingly will be more suitably described when discussing the mechanism.

(3) **The Effect on the Mechanism of Expulsion.**—**In all cases, the mechanism of the expulsion of the fœtus depends on the relation**

between the different diameters of the fœtal head and the different diameters of the pelvic brim. If these two sets of diameters preserve their normal relation to one another, the mechanism of expulsion in vertex presentation is that described as the normal mechanism. If the relation becomes altered; then alterations in the normal mechanism are met with. These alterations are, as a rule, such as tend to bring the process of expulsion into conformity with the conditions present, and consequently may be regarded as the 'normal' mechanism under these special conditions. Thus, we find that the head has a special mechanism in cases of flattened pelvis, another special mechanism in cases of generally contracted pelvis, and, again, another in cases of generally contracted and flat pelvis, and that the head has the best chance of passing through the narrow brim only when this mechanism occurs. The form of mechanism peculiar to the different varieties of contracted pelvis will be described when discussing these forms.

(4) The Effect on the Uterus and Vagina.—Any of the different forms of uterine laceration, which have been already described, may occur in contracted pelvis. If either the lower uterine segment or the cervix is nipped between the descending head and the bony pelvis, it becomes œdematous, owing to the obstructed return of blood through the veins. This condition, if relieved as soon as it is recognised, is not of any great consequence, but, if allowed to persist, it may lead to serious results. In the first place, an œdematous cervical lip offers an additional obstruction to delivery, and may cause rupture of the lower uterine segment. Secondly, the anterior lip, or even the entire cervical ring, may be torn off by the descending head. In the third place, the portion of cervical tissue which is nipped may slough, and a fistula result. Besides these consequences of nipping, the uterus may rupture in its lower segment as a result of the additional obstruction offered to delivery by the pelvic contraction.

Laceration and sloughing of the vagina may also occur in cases in which the head has passed the brim. Lacerations may be the result of an extension of a cervical tear into the posterior fornix, and sloughing and the subsequent formation of fistulæ are due to the compression of the vaginal wall between the presenting head and the bony pelvis. As a rule, such fistulæ form between the bladder and vagina, but occasionally they form between the vagina and rectum.

(5) The Post-partum Effects of Pelvic Contraction.—The post-partum effects of pelvic contraction are due to the length of labour, the bruising and laceration the soft parts undergo, and the intra-pelvic manipulations that are necessary. They consist chiefly of an increased tendency to post-partum hæmorrhage, due to the long-continued labour and consequent exhaustion of the uterine muscle; of an increased liability to sapræmic and septic infection, due to the lowered resistance of the tissues brought

about by their bruising, to the stagnation of liquor amnii in the vagina, and to the necessary intra-pelvic manipulations; and of the formation of fistulæ, due to the nipping of the soft parts.

THE GENERAL TREATMENT OF CONTRACTED PELVIS.

We shall here discuss briefly the general principles of the treatment applicable to the common forms of contracted pelvis, and, subsequently, we shall discuss the special treatment to be adopted in each particular form. As we have already mentioned, in the common forms of contracted pelvis four degrees of contraction are recognised. In the first degree, the conjugate measures from 4 to 3¼ inches in flat pelvis, or from 4 to 3½ inches in generally contracted pelvis. This degree of contraction is not sufficient to prevent the passage of a fully-formed infant through the pelvis under otherwise favourable circumstances, and consequently does not, as a rule, necessitate operative interference. One of two lines of treatment may be adopted:—either the expulsion of the fœtus may be left entirely to Nature until the head has passed through the site of the pelvic narrowing; or podalic version may be performed, and the fœtus extracted as a pelvic presentation.

The first of these lines of treatment allows the head to mould through the brim, and to follow whatever particular mechanism is most suited to the form of contraction present. It may, however, fail to effect delivery in consequence of the uterine contractions being insufficiently strong to overcome the resistance present. In such cases, the application of the forceps will supplement the natural force supplied by the contractions of the uterus, and so will sometimes enable a head to overcome a resistance which it could not have overcome when alone driven down by the uterine contractions. The application of the forceps has, however, the disadvantage that, if the head is not fixed in the brim, the control, which the forceps exercises over the presenting head, prevents the latter from following the particular mechanism suited to the nature of the contraction, and also, as will be seen, increases the lateral diameters of the head. If, however, the head has passed the site of contraction, the forceps does not tend to increase the difficulty of delivery, and so may be more safely employed.

The second line of treatment, *i.e.*, prophylactic podalic version, enables any required degree of additional force to be supplied, and also allows us to take advantage of the natural shape and formation of the head. When the head of the fœtus presents and is dragged down against a narrow brim by the forceps, the combined effect of the resistance offered by the brim to the descent of the head and of the downward traction applied to the base of the skull by the forceps, is to cause a lateral bulging of the cranial walls, and so an increase in the lateral diameters of the head, the disproportion between the head and the narrow brim being thus increased. The effect of this is well shown in the diagram (*v.* Fig. 301). When, on the other hand, the fœtus is extracted as a pelvic presentation and the head comes last, the base, or narrow part of the head, enters the brim first and the wider portions follow, the head thus resembling a wedge driven down into the brim. The result of this is that the narrow brim, instead of causing an increase in the lateral diameters of the head, causes a diminution, as each successive diameter as it comes down is compressed laterally, and consequently the disproportion between the head and the narrow brim is lessened and not increased by traction, as in the former case. Furthermore, the head can be brought through the pelvis in such a manner that its longest diameters correspond to the longest diameters of the pelvis, and full advantage can be taken of the temporary increase in size of the pelvic brim which is obtained by placing the patient in Walcher's position. The patient can readily remain in this position for the short time necessary for the extraction of an after-coming head, but it is impossible to keep her in such a position during the varying number of hours that the fore-coming head takes to mould through the brim. The gross gain in the length of the true conjugate obtained by Walcher's position is about one centimetre or two-fifths of an inch, and this is often of considerable value.

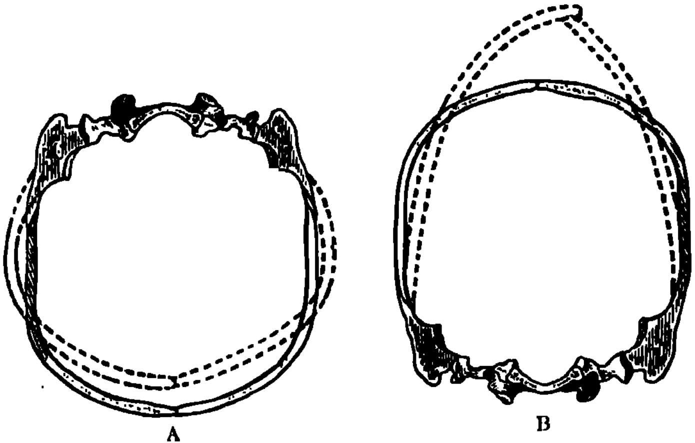

FIG. 301.—THE CHANGE OF SHAPE THAT OCCURS IN, A, THE PRESENTING HEAD, AND, B, THE AFTER-COMING HEAD, WHEN COMPRESSED BY THE BRIM OF A CONTRACTED PELVIS.

The firm outline is that of the unmoulded head, the dotted outline that of the moulded head.

Prophylactic version has, however, also certain disadvantages attaching to its use. When the head of the fœtus comes first, it can take an indefinite period, comparatively speaking, to pass through the brim, as there is not necessarily any interference with the circulation in the umbilical vessels. When, however, the head comes last, it cannot be allowed to take more than two minutes to pass through, as during the entire time it is passing through the pelvic cavity the umbilical cord is being compressed and circulation in it checked. Therefore, delivery must be very rapidly effected, or else the object with which the line of treatment has been adopted, *i.e.*, the preservation of the life of the fœtus, is not attained. As we shall subsequently see, prophylactic version is only applicable to cases of flattened pelvis, as, in generally contracted pelvis, the diminished transverse diameter of the pelvis prevents the long antero-posterior diameters of the head from finding room, and also tends to bring about extension of the head —an occurrence which would be fatal to the life of the fœtus. Version performed in suitable cases, and by a capable obstetrician, is a valuable procedure, and improves the prognosis for both mother and fœtus. Version performed in an unsuitable case, in which the subsequent delivery of the unmutilated fœtus is impossible, greatly increases the difficulty of effecting delivery, for, while the perforation and extraction of the presenting head is a comparatively easy matter, the same procedure in the case of an after-coming head may be, and usually is, most difficult.

Accordingly, we see that each line of treatment presents certain advantages and certain disadvantages. Allowing the head to mould through the brim is a satisfactory procedure, if the disproportion is not too great, and if the uterine contractions are of their normal strength. If the latter are not of their normal strength, the application of the forceps is useful after the head has passed the brim, and even in cases in which the head has not passed the brim it may sometimes be successful. Prophylactic version is useful in flattened pelves. If it is selected as the line of treatment, external version should be performed as soon as the os is sufficiently dilated to admit two or three fingers, and a foot be drawn down in order to minimise the risk of impaction of the breech in the pelvis and to give something on which we can apply traction if necessary. If the premature rupture of the membranes prevents the performance of external version, internal version must be performed as soon as the uterine orifice is sufficiently dilated to allow the introduction of the hand. If we decide to allow the head to mould through the brim, the case must be closely watched through the whole labour, and delivery immediately effected if the symptoms of threatened rupture of the uterus appear.

It is customary in many text-books to labour at a comparison between the application of the forceps and prophylactic version, as two competing lines of treatment in this degree of contracted pelvis. We confess, however, that we consider it a mistake to force a comparison. These two methods are in no sense competing methods. In the first place, the application of the forceps cannot be truly regarded as a distinct line of treatment. It is an adjunctory treatment, which is adopted as a last resource in cases in which the head has been left to mould through the brim, but in which the uterine contractions are not sufficiently strong to bring the head through. It should never be adopted until moulding fails, as in the great proportion of cases the latter offers a better prospect of success. In the second place, in cases in which the application of the forceps is advisable, version is contraindicated, because the patient has been for a long time in labour, and the condition of the uterine muscle forbids such intra-uterine manipulation. Some writers, notably Galabin,* regard the relative position of the forceps and version in a different light. Galabin considers that once the existence of any considerable degree of contraction is recognised, the application of the forceps should not be long delayed, and that if it fails to effect delivery version may be then performed. He supports his view by statistics which show that, after forceps application, 88·1 per cent. of children were born alive, and after version 71·4. If, however, version was only adopted in cases in which the forceps had already failed, it is obvious that 71·4 per cent. cannot be regarded as the true percentage of living children that can be obtained by *prophylactic* version, since many of the deaths must have been the result of ineffectual efforts at delivery by the forceps. Furthermore, the writer in question in his comparison does not appear to distinguish sufficiently between cases of flattened and of generally contracted pelvis.

There is, of course, another line of treatment which can be adopted in all cases. As, however, it is never the treatment of choice and is only adopted under compulsion or in the case of the death of the fœtus, we have not included it with the others. It is the performance of craniotomy, an operation which is necessary when other procedures fail. If, however, we have diagnosed the nature and degree of the contraction correctly, craniotomy should rarely or never be required, since, when delivery by one of the foregoing methods is impossible, Cæsarean section or symphysiotomy should be performed. To be compelled to perform craniotomy as a last resource is a tacit confession that for some reason or other we have failed in the treatment of the case. In practice, however, accurate diagnosis is at times impossible, as the actual size and hardness of the fœtal head are factors which it is difficult to estimate correctly, and, if our measurements show that we are dealing with a contraction of the first degree, we can only adopt the measures which have been proved to be usually successful in that degree, and fall back on craniotomy if they fail. The advice of Spiegelberg, founded on his great experience, is well worthy of being reproduced, and though it must perhaps be slightly modified to suit conditions other than those under which he practised, it is very doubtful if it can be improved:—'When, and so long as, the spontaneous passage of the head appears to be possible and free from danger, wait. When the condition of the mother forbids any further delay, perforate and extract with the cranioclast, if the head is still high; apply the forceps, if the region of the contraction has been passed, and the child is alive. . . . The life of the child must always be of little weight in comparison with that of the mother; every operative interference involves great risk for it, and its prospects are on the whole best when labour takes its own course.' The modification, which altered conditions of practice may necessitate, is to be found in the use of the forceps when the head is not fixed, and when the condition of the mother forbids further delay. It is extremely improbable that in cases of flattened pelvis the fœtus will be saved by so doing, but if even the slightest chance of life is afforded by the use of the forceps many obstetricians will consider that it is their duty to use it. In generally contracted pelvis, on the other hand, the application of the forceps may be often successful, and, as the diagnosis of the exact form of contraction present is often uncertain, it follows that in all cases the forceps will be given a trial when the condition of the mother forbids further delay, whether the head is or is not fixed, provided that the fœtus is alive. If it fails to effect delivery, craniotomy must be then performed.

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* *Op. cit.*, p. 543.

In the second degree of pelvic contraction, the conjugate measures from 3¼ to 2¾ inches in flattened pelves, or from 3½ to 3 inches in generally contracted pelves. In this degree, the expulsion of a fully-formed fœtus by the natural efforts or its extraction by the forceps may be regarded as impossible. If the case is seen sufficiently early in pregnancy, the ideal mode of treatment consists in the induction of premature labour, a procedure which may also be adopted with advantage in cases of narrowing of the first degree in which previous efforts to obtain a living fœtus by the procedures just recommended have proved unsuccessful. If the case is seen too late to induce premature labour, and if a living child is to be obtained, prophylactic version, symphysiotomy, or Cæsarean section must be performed. The most important point in the induction of premature labour is the determination of the correct date at which to induce it. If labour is induced too early, the fœtus is more immature than is necessary, and consequently the difficulty of rearing it is greater. If labour is induced too late, the fœtus may be too large to pass through the brim, and consequently the operation has been undertaken for nothing. The date at which to induce labour can be ascertained in two ways. The first is the more theoretical, and consists in ascertaining the exact duration of pregnancy and the average size of the fœtal head at the different weeks, and in then inducing labour during the last week at which we consider that a head of average size can pass through the pelvis with which we are dealing. The following table shows the week at which labour should be induced in accordance with the size of the true conjugate in a flattened and in a generally contracted pelvis :—

Length of Conjugate in Flat Pelvis.	Length of Conjugate in Generally Contracted Pelvis	Time to induce Labour.
2¾ ins. (7 cms.)	3 ins. (7·5 cms.)	28th week.
3 ,, (7·5 cms.)	3¼ ,, (8·25 cms.)	30th ,,
3¼ ,, (8·25 cms.)	3½ ,, (9 cms.)	32nd ,,
3½ ,, (9 cms.)	3¾ ,, (9·5 cms.)	34th ,,

This method of ascertaining the date is unsatisfactory, as it is impossible to estimate the exact age of pregnancy, and even if this can be done, the method takes no account of the varying sizes of the fœtal head at similar periods of pregnancy. It is useless to induce labour before the twenty-eighth week as the fœtus would be immature, or after the thirty-sixth week, as from that date onwards there is little or no increase in the size of the fœtal head, and consequently induction of labour will not make delivery any easier.

The second method was introduced by Müller[*] and Schatz,[†] and is more satisfactory than the foregoing. It consists in attempts, made from time to time, to push the head of the fœtus into the pelvic brim. The first attempt is made in or about the twenty-seventh week as nearly as we can guess, and is repeated every six to eight days. The patient is placed in the cross-bed position or on a gynæcological couch, and the obstetrician passes two fingers into the vagina and upwards until they touch the presenting head. The head is then grasped with the left hand, the fingers over the occiput, and the thumb over the chin, or *vice versâ*, according to the position of the fœtus, and is pressed into the brim, while an assistant supplements this force by also pressing down with both his hands superimposed on those of the operator (*v.* Fig. 302). So long as it is possible to push the greatest diameter of the head through the brim, it is too soon to induce labour, but the first day we are unable to do this labour may be induced. The contractions of the uterus can drive through the brim a head which could not be pushed through in the manner described.

If the patient is not seen until pregnancy is too far advanced to permit the induction of labour, delivery may sometimes be effected, in the case of flattened pelves, if prophylactic version is performed, and the patient placed in Walcher's position during the extraction of the head. The adoption of this treatment by any but a skilled obstetrician with the necessary assistance at hand cannot be recommended in cases in which the conjugate is below three inches. The difficulty of extracting the head through a smaller brim is so considerable that there is but little chance of obtaining a living fœtus, and there is considerable risk of bringing about impaction of the head and so necessitating the performance of perforation—always a difficult operation in these cases. A skilled obstetrician will frequently be able to extract a living child even in this degree of contraction, provided that the child is not above the normal size, and that he is dealing with a case of flattened and not of generally contracted pelvis. The performance of prophylactic version in a generally contracted pelvis of this degree would be a most inadvisable procedure.

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[*] 'Ueber die Prognose der Geburt bei engen Becken,' *Archiv. f. Gyn.*, 1896, vol. xxvii., p. 311.

[†] *Centralbl. f. Gynäk.*, 1885, vol. ix., p. 660.

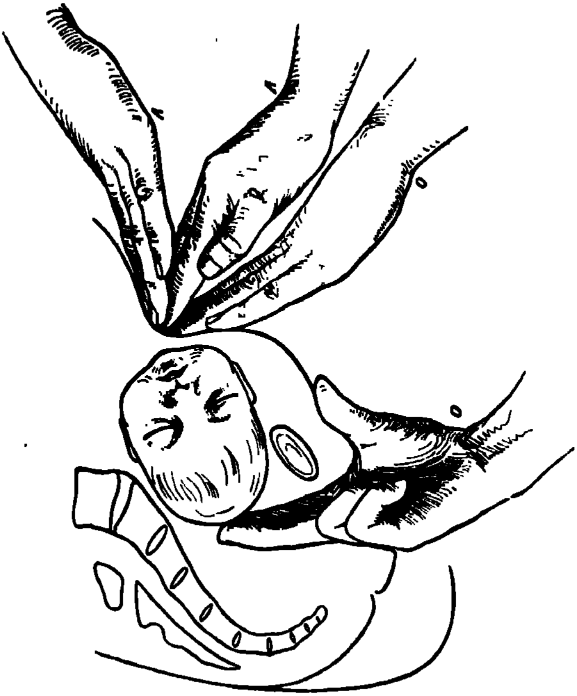

FIG. 302.—MÜLLER'S METHOD OF ASCERTAINING THE DATE AT WHICH TO INDUCE LABOUR.

O O, Operator's hands; *A A*, assistant's hands.

If prophylactic version is deemed to be inexpedient, either because it has failed to procure a living child in former labours, or because the apparent size of the fœtus or the nature of the contraction contra-indicates it, we must choose between symphysiotomy and Cæsarean section. Which of these two ought to be selected depends upon the previous experience of the operator, and the circumstances under which the case is operated upon. If the obstetrician possesses a knowledge of the method of performing the operation, if he has sufficient assistance, and if the patient is sure of skilled nursing subsequently, symphysiotomy presents certain advantages. On the other hand, Cæsarean section is an easier operation, and can be performed in an emergency with a minimum of assistance. Moreover, its technique and prognosis have been so improved of late years that it is no longer the formidable operation it was previously considered to be. If symphysiotomy is chosen, it should be performed as soon as the uterine orifice has reached a sufficient size to permit the passage of the fœtus. If the premature rupture of the membranes prevents the dilatation of the orifice, dilatation must be effected by dilators or by incision. As soon as the symphysis has been divided, the fœtus is extracted with the forceps, or, version having previously been performed, as a pelvic presentation. If Cæsarean section is selected, the operation should be performed, if possible, prior to the rupture of the membranes, but not until the uterine orifice is sufficiently dilated to allow the subsequent free escape of the lochia.

If prophylactic version is considered unsuitable, and if the circumstances of the case forbid the performance of Cæsarean section or symphysiotomy, there is no other course open save craniotomy. This operation is adopted as a matter of course in all cases in which the fœtus is dead, but is rarely required at the present time when the fœtus is living, as the advance in obstetrical knowledge and technique has provided us with the means of saving the life of both mother and child in almost every case. Many obstetricians hesitate to perform craniotomy on a living fœtus even when there is no alternative, and many more are forbidden to do so by their religious convictions. It is unnecessary to enter at any length into the permissibility of the operation, and it is sufficient to say, first, that it is only when all other means of effecting delivery are impossible that it is permissible; secondly, that in the large majority of such cases the fœtus is no longer living when craniotomy is actually performed, and that hence the necessity for perforating a living fœtus is extremely rare; and, lastly, that, in those cases in which the perforation of a living child is necessary, it must be remembered that we have to make a choice between the destruction of the fœtus and the destruction of both mother and fœtus; that, in other words, it is not a case of saving the fœtus at the cost perhaps of the mother's life, but of losing the life of the latter without in any way benefiting the former.

In the third degree of contraction, the conjugate measures from 2¾ to 2¼ inches in flattened pelvis, or from 3 to 2½ inches in generally contracted pelvis, but this degree of narrowing is rarely met with in the latter form of pelvis. It is sufficient to prevent the passage through the pelvis of even a premature fœtus unless reduced in size by craniotomy, and even symphysiotomy will not afford sufficient space for the passage of a full-term fœtus. Consequently, if the life of the latter is to be saved, Cæsarean section must be performed. If the conditions of the case forbid the performance of Cæsarean section, or if the fœtus is dead, craniotomy must be performed.

In the fourth degree of pelvic contraction, the conjugate measures 2¼ inches or less in flattened pelvis, or 2½ inches or less in generally contracted pelvis, but it is doubtful if this degree of narrowing is ever met with in the latter class of deformity. This degree is known as absolute pelvic contraction, and, in it, the disproportion between the head and the pelvis is such that it is impossible to bring even a mutilated fœtus through the pelvic cavity, consequently in all these cases Cæsarean section must be performed.

Prognosis.—The prognosis for both mother and fœtus is always serious in contracted pelvis. While the severe degrees of contraction expose the mother to all the dangers attendant on the performance of a major operation, the slight degrees expose her to the risks that necessarily attend a long labour, frequent vaginal examinations and manipulations, and severe bruising of the soft tissues. Spiegelberg estimated that the average maternal mortality in all cases in which pelvic contraction was present amounted to about 7·9 per cent., and the fœtal mortality to 32 per cent. Amongst the common forms of contraction—generally contracted pelvis, flat pelvis, and generally contracted flat pelvis, the prognosis for both mother and fœtus is best in the generally contracted pelvis, and the mortality has been estimated at 6·8 per cent. for the mother, and 9·5 per cent. for the fœtus. In the flat pelvis, the maternal mortality is estimated at 7·7 per cent., the fœtal mortality at 60 per cent. In the generally contracted flat pelvis, the mortality both for mother and fœtus is worst, and is estimated at 8·3 per cent. for the mother, and at 66 per cent. for the fœtus. These figures are given by Winckel and Litzmann; if they are correct the average fœtal mortality of 32 per cent. in all cases of deformity given by Spiegelberg is too low.

CHAPTER III

THE COMMON FORMS OF CONTRACTED PELVIS

Generally Contracted Pelvis — Rachitic — Non-rachitic — Dwarf. Flattened Pelvis—The Flat Pelvis, Non-rachitic, Rachitic—The Generally Contracted Flat Pelvis, Non-rachitic, Rachitic—Pelvis of Congenital Dislocation of the Hips.

THE common forms of contracted pelvis are met with in the first two classes of the classification we have adopted. These groups are as follows:—

I. GENERALLY CONTRACTED PELVIS.
  (1) Generally contracted pelvis.
    (*a*) Non-rachitic.
    (*b*) Rachitic.
  (2) Dwarf pelvis.

II. FLATTENED PELVIS.
  (1) Flat pelvis.
    (*a*) Non-rachitic.
    (*b*) Rachitic.
  (2) Generally contracted flat pelvis.
    (*a*) Non-rachitic.
    (*b*) Rachitic.
  (3) Pelvis of congenital dislocation of hips.

Of the different varieties of pelvis included in these two classes, only four can be regarded as common. These are as follows:—

I. (1) (*a*) The generally contracted non-rachitic pelvis.

II. (1) The flat pelvis, both non-rachitic and rachitic.
  (2) (*b*) The generally contracted flat rachitic pelvis.

As, however, the other and rare varieties included in Classes I. and II. are so similar to the common varieties, both anatomically and in their effect upon labour, we shall discuss all the varieties met with in Classes I. and II. in the same chapter.

GENERALLY CONTRACTED PELVIS.

A generally contracted pelvis, a small round pelvis, or a *pelvis æquabiliter justo-minor*, are the terms applied to a pelvis in which all the diameters are smaller than normal, but still preserve their normal relation to one another.

Varieties.—The following varieties of generally contracted pelvis are met with:—

(1) Generally contracted pelvis.
  (*a*) Non-rachitic.
  (*b*) Rachitic.
(2) Dwarf pelvis.

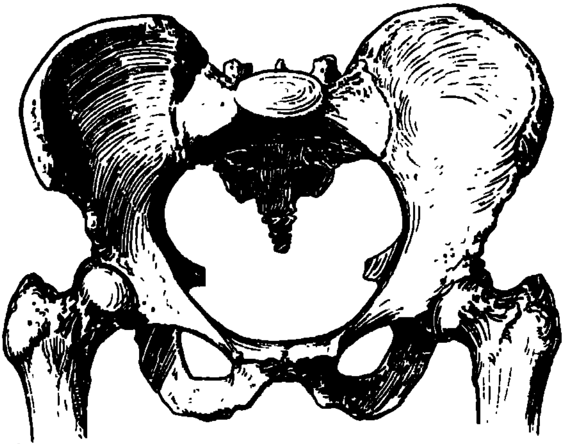

FIG. 303.—THE GENERALLY CONTRACTED NON-RACHITIC PELVIS *

Frequency.—All the varieties of generally contracted pelvis are less common than are those of flattened pelvis, and the only variety which can be regarded as at all common is the generally contracted non-rachitic pelvis. The generally contracted rachitic pelvis is extremely rare, as rickets almost invariably tends to produce pelvic flattening. The dwarf pelvis is also of extreme rarity. According to Winckel's statistics, generally contracted pelvis and generally contracted flat pelvis taken together constitute only 1·67 per cent. of all pelvic deformities.

GENERALLY CONTRACTED PELVIS.—Although in our classification we have divided this form of pelvis into non-rachitic and rachitic, it is more convenient to discuss both varieties together, since they are very similar in conformation; and, apart from the history of the individual and from such general signs of mild rickets as may be found in other parts of the skeleton, it is almost impossible to distinguish them in the living.

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* The set of drawings of contracted pelvis in this and the next chapter were specially made for this book from the collection of the late Professor Milne Murray, of Edinburgh, who had devoted much time and labour to the perfecting of it.

The generally contracted pelvis is most commonly found in women below the average size, and is then in keeping with the general skeletal development. It has also been occasionally observed in women of normal or even of large size, especially in those whose general form approaches the masculine type. It presents the appearance of a normal female pelvis, in which all the diameters are diminished in length. This diminution is usually so proportioned that the diameters retain their normal relation to one another. Sometimes, the shortening is more marked in one diameter than in another, most frequently in the conjugata vera, and produces in such a case a condition which approximates to the generally contracted flat pelvis, and which is usually the result of mild rickets (rachitic variety). Further evidence of this disease may possibly be found in extreme prominence of the ilio-pectineal lines.

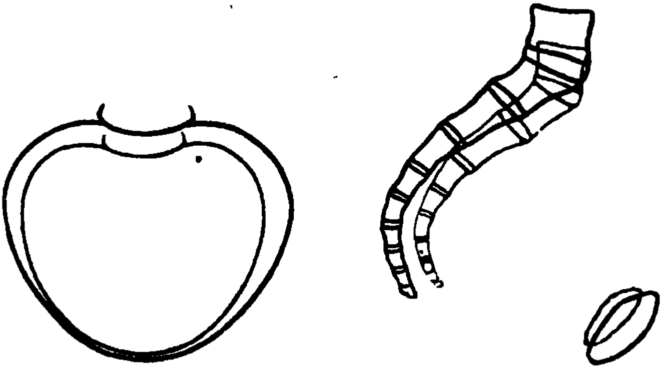
A B

FIG. 304.—THE GENERALLY CONTRACTED NON-RACHITIC PELVIS.

A, Outline of the brim; B, sagittal section. (Outline of normal pelvis in black, of contracted pelvis in red.)

The cause of contraction in non-rachitic cases is unknown, but the deformity has been ascribed to the carrying of heavy weights in childhood, thus throwing an excessive strain upon the pelvis, or to such general diseases as anæmia, which may produce a universal arrest of development.

There is a variety of the justo-minor pelvis which is called the *infantile* or *juvenile* form, because it retains the characteristics of the pelvis found in children. In these cases, development has followed a normal course up to a certain period, but has then ceased from some unknown cause. The narrowing in this form may be extreme, but is very irregular, and often most marked at the outlet. The sacrum is narrow, and its lateral masses are ill-developed. It retains its position far back between the iliac bones, and the promontory lies at a relatively high level, so that the inlet is somewhat oval in shape, the transverse diameter being more contracted than the antero-posterior. The position of the sacrum, and the fact that its vertical curvature is rather less than normal, make it appear as if the weight of the trunk had been unable to produce its usual effects during growth, perhaps on account of premature consolidation of the sacral vertebræ.[*]

THE DWARF PELVIS.—The dwarf pelvis, or *pelvis nana*, is most often the result of a severe type of rickets, or some similar disease of the bones, occurring either in fœtal or in early extra-uterine life, and causing a general cessation of development of the body. It occurs in true dwarfs, in whom a cause for their small size cannot be detected. The bones are slight and often remain united by cartilage, and the contraction, as a rule, is extreme throughout the whole canal.

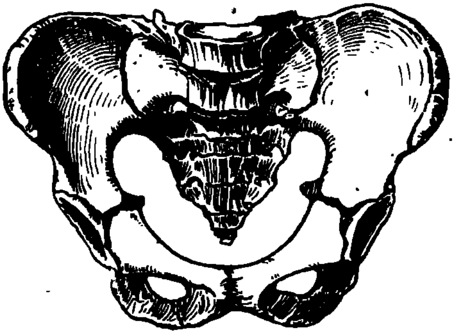

FIG. 305.—THE GENERALLY CONTRACTED PELVIS. THE DWARF PELVIS.

Symptoms.—We have already referred to the symptoms of contracted pelvis which are common to all forms of contraction, and shall here alone refer to those which are peculiar to the special form with which we are dealing. We may discuss these special symptoms under similar headings to those under which we previously discussed the general symptoms.

(1) Effect on the Relation of the Head to the Brim.—As the degree of contraction which is usually met with in this form is not so great as in flattened pelvis, and as the brim preserves its normal shape, the uterus is not displaced upwards during pregnancy to any very great extent, and the presenting vertex fits the

[*] Winckel, 'Text-book of Midwifery,' p. 466.

brim almost as in normal cases. In consequence of this, pendulous abdomen and malpresentations are not the rule, the head fills the lower segment of the uterus in the usual manner, and the liquor amnii does not tend to escape very suddenly or completely.

(2) Effect on the Fœtus.—The caput succedaneum is of large size, and forms in the region of the posterior fontanelle. The occipito-mental diameter of the head is greatly elongated, the head appearing as if it had been drawn out. The occipital and frontal bones are driven under the parietals. As a rule, there are no definite areas of compression, resembling the dints and furrows which occur in flattened pelves, inasmuch as the pressure on the head is fairly uniform, but ecchymoses and red patches, due to the pressure of the promontory, occasionally occur. The most characteristic mark is said to be a red stripe, running from the parietal bone towards the eye or upper jaw, and caused by the pressure of the promontory.

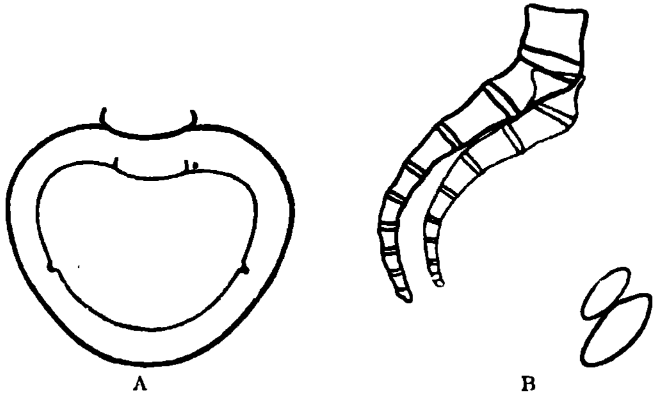

FIG. 306.—THE DWARF PELVIS.
A, Outline of brim; B, sagittal section. (Outline of normal pelvis in black, of contracted pelvis in red.)

(3) Effect on the Mechanism of Expulsion.—If the head is to pass through a pelvic brim all of whose diameters are lessened, it is obvious that its smallest diameters must come into relation with the diameters of the brim. Accordingly, we find that the degree of flexion is very much more marked than it is under normal circumstances, and that the posterior fontanelle presents at the brim. This increased flexion is due to the increased resistance to the descent of the head; the greater the degree of contraction, the more marked it is, and in some cases it may proceed so far that, not the posterior fontanelle, but the occipital bone presents. The head consequently engages with a diameter posterior to the sub-occipito-bregmatic diameter in the oblique diameter of the pelvis, and in a synclitic manner—that is, with

the line joining the parietal eminences parallel to the plane of the brim, thus contrasting markedly with the mode of engagement in flattened pelvis. Once the head has passed the brim, the remaining mechanism resembles that of a normal case, save that internal rotation occurs at an earlier stage, and is more complete than usual. This is due to the fact that obstruction to the passage of the fœtus does not cease as soon as the head has passed through the brim, but is maintained during its passage through the pelvic cavity. Consequently, the head is forced to bring its diameters into as complete conformity as possible with the diameters or the brim.

(4) Effect on the Uterus and Vagina.—Inasmuch as the head completely fills the brim in generally contracted pelvis, it tends to press uniformly all round upon the lower uterine segment and other pelvic structures. In consequence of this, there is first a tendency to the occurrence of œdema of all the tissues below the girdle of contact, and secondly an increased risk of the cervix being torn off as a ring. Laceration of the uterus other than in this way is rare, as extreme degrees of contraction seldom occur, and as the condition of affairs is more readily recognised early in labour than it is in flattened pelvis.

Diagnosis.—The diagnosis of generally contracted pelvis is made by finding on measurement that all the diameters of the brim are diminished in length, but that they still preserve their normal relation to one another.

Treatment.—In contraction of the first degree, delivery must be left for as long as possible to the natural efforts, in order to allow the head to mould through the brim, as this method of treatment offers the best prospect of success. Prophylactic version is contra-indicated in generally contracted pelvis, for the reasons already mentioned. Premature rupture of the membranes is not so liable to occur in this form of contraction as in flattened pelvis, and so the first stage of labour will probably proceed normally. The patient should remain in bed, to minimise any risk of rupture of the membranes, and should lie on the side towards which the posterior fontanelle is turned, in order to favour the descent of the latter, and so assist the mechanism peculiar to this form of contraction. If the head continues to descend, no further interference need take place. If, on the other hand, the head becomes impacted and ceases to advance, it is best to attempt to deliver the fœtus at once, and not to wait until œdema of the vagina occurs. If the fœtal heart can be heard, an attempt may be made to extract the fœtus with the forceps, and, in this degree of contraction, will probably be successful, provided that deep engagement of the posterior fontanelle has occurred. If the fœtus is dead, or if attempts at extraction with the forceps fail, it will be necessary to perform craniotomy.

In the second degree of pelvic contraction, premature labour must always be induced if the case is seen sufficiently early in pregnancy. When this course has not been adopted, a choice must be made between symphysiotomy and Cæsarean section, if the fœtus is to be saved. Prophylactic version is contra-indicated for the reasons already given. If the circumstances of the case forbid the performance of the first-named operations, craniotomy must be performed, unless it is obvious that the head of the fœtus is very small, when attempts to extract it by means of the forceps are perhaps permissible. Attempts to drag a normally-sized head through a pelvis of this size would lead to so much laceration of the maternal soft parts that they are quite unjustifiable.

FLATTENED PELVIS.

A flattened pelvis is one in which the chief contraction occurs in the conjugate diameter, and in which the other diameters either remain approximately unaltered in length or exhibit a slight general contraction.

Varieties.—The following varieties of flattened pelvis are met with :—

- (1) Flat pelvis.
  - (*a*) Non-rachitic.
  - (*b*) Rachitic.
- (2) Generally contracted flat pelvis.
  - (*a*) Non-rachitic.
  - (*b*) Rachitic.
- (3) Pelvis of congenital dislocation of the hips.

Frequency.—The non-rachitic and rachitic flat pelves are the varieties of pelvic deformity most commonly met with. According to Winckel's statistics, they occur in 95·53 per cent. of all cases of pelvic deformity. The rachitic generally contracted flat pelvis is next in frequency, and is said to be the only variety of extreme pelvic deformity met with in England (Herman). It is, however, rare in comparison with flattened pelvis, and according to Winckel only constitutes about one per cent. of cases of pelvic deformity. The non-rachitic generally contracted flat pelvis and the pelvis of congenital dislocation of the hips are, on the other hand, among the rarest forms of deformity.

THE FLAT PELVIS.—The essential feature of both the non-rachitic and the rachitic varieties of flat pelvis is a diminution in the length of the true conjugate, unaccompanied by any diminution in the other diameters. Although this characteristic is common to both varieties, the exact anatomical features differ in each variety, and consequently must be described separately.

The Non-rachitic Flat Pelvis.—The flattened non-rachitic or simple flat pelvis is, except in minor degrees, only rarely met with. Its causation has not as yet been definitely determined, though some writers, regarding it as really the result of mild rickets, consider that it should more properly be classified along with the rachitic variety. It is more generally believed, however, to be produced by very severe work, involving much standing and the carrying of heavy weights during childhood, when the bones are in a plastic condition. Probably this is a predisposing factor in the majority of cases, but since no deformity of the sacrum exists, it would seem that some abnormal laxity or weakness of the posterior sacro-iliac ligaments must also be present to permit of simple displacement of that bone. It is probable that in some cases such a relaxation takes place at the period of puberty, as a result of anæmia and general debility, which in their severe forms lead to the lateral curvature of the spine so common at this age.

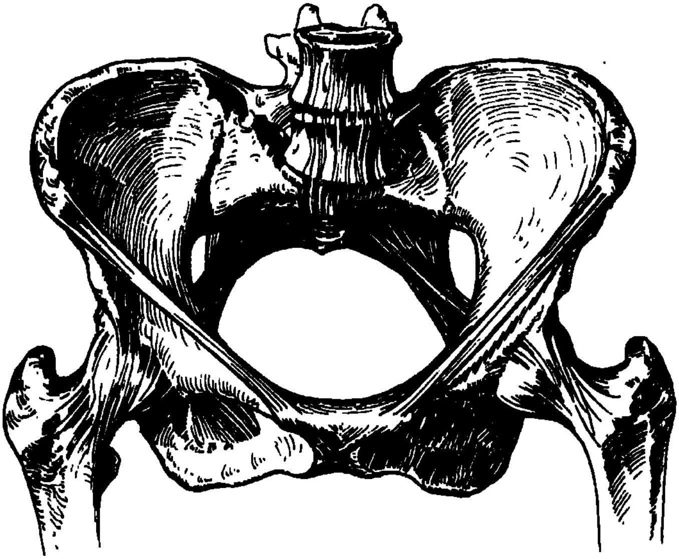

Fig. 307.—The Flattened Pelvis. Rachitic Flat Pelvis. Typical Minor Degree.

The sacrum is normal in shape, but, without any rotation around its transverse axis, it is displaced bodily downwards and forwards into the pelvis, and thus produces an antero-posterior contraction, which is slightly more marked at the inlet, but is also present throughout the whole extent of the pelvis. In comparison with the conjugate, the transverse and oblique diameters are relatively lengthened. Sometimes, the transverse diameter is actually lengthened, but in the majority of cases it is slightly shortened. The whole pelvis, indeed, is often small, and this is usually regarded as evidence that there is a general slight arrest of development in the pelvic bones, since, if this was not the case, the flattening would necessarily produce a compensatory increase in the transverse diameter. On this account, the deformity is often supposed to be the result of congenital causes. If, however, we suppose the deformity to be produced at puberty in the manner described, there is no need to assume such a hypothesis, since, owing to the elongation of the posterior arm of the iliac lever, the ossa innominata at that period are sufficiently firm to resist the *increased* outward force exerted upon them in the region of the acetabula. Moreover, the general arrest of development brought about by anæmia is sufficient to account for the smallness of the pelvis. This view is borne out by the fact that, in many cases, when the transverse diameter is diminished in length, the os innominatum is not unduly curved.

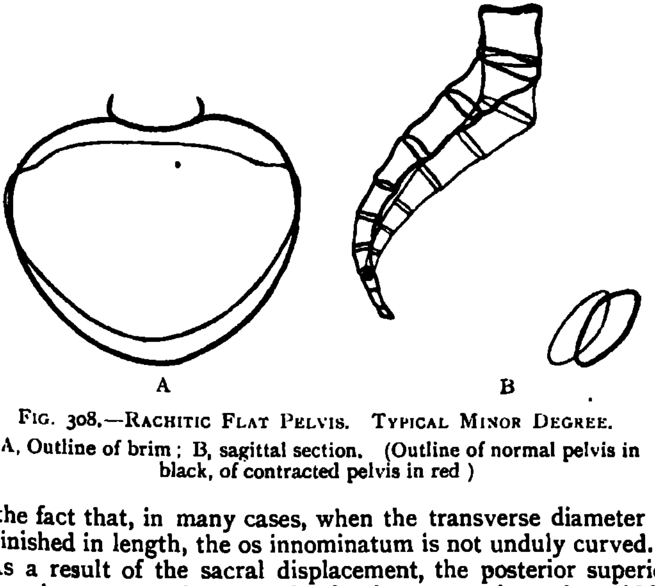

FIG. 308.—RACHITIC FLAT PELVIS. TYPICAL MINOR DEGREE.
A, Outline of brim; B, sagittal section. (Outline of normal pelvis in black, of contracted pelvis in red)

As a result of the sacral displacement, the posterior superior iliac spines approach more closely than normal to the middle line behind the sacrum, and thus constitute an important aid to the diagnosis of the condition.

The Rachitic Flat Pelvis.—The changes found in the rachitic variety of flattened pelvis are, for the most part, the direct results of the pressure of the body-weight acting downwards through the sacrum, and of the counter-pressure* acting upwards and inwards through the heads of the femora upon bones which have become softened and atrophic from disease. The amount of flattening and general deformity produced depends, first, upon the duration and severity of the rickets, and, secondly, upon the forces acting upon the pelvis.

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* The counter-pressure alone does not act inwards, but the combined forces of the reaction to body-weight and of muscular action act upon the acetabula in the direction stated.

In infants, the body-weight is the most important of these forces, and is responsible for the greater part of the deformity since the disease usually sets in before walking or standing is attempted, and having once set in, prevents both walking and standing. For this reason, there is but little counter-pressure against the acetabula, and the effects of muscular action, though manifest, are diminished. The changes which rickets produces in the skeleton are twofold. First, it retards, and even for a time completely arrests, bony development, and therefore the pelvis is found to retain throughout life several of its infantile characteristics. Secondly, distinct pathological changes occur. The bones become softened owing to a deficiency in the deposition of calcium salts, and the amount of cartilage in the neighbourhood of joints and between the growing ends of the bones becomes increased in amount. This latter change is especially marked in the acetabular cartilage which unites the ilium, ischium and os pubis, and the innominate bones are in consequence liable to yield at this weakened part. When recovery once sets in the bones rapidly ossify, and, in the adult, their structure is sometimes normal. As a rule, however, they are more slender and thinner than normal, or else unusually dense and hard. In some pelves, localised deposits of bone beneath the periosteum are laid

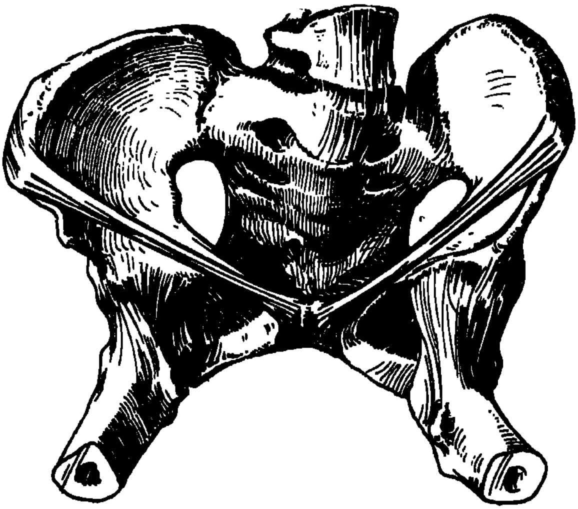

FIG. 309.—THE FLATTENED PELVIS. RACHITIC FLAT PELVIS. AN EXTREME DEGREE ASSOCIATED WITH DISLOCATION OF LEFT SACRO-ILIAC JOINT AND CONSEQUENT SLIGHT OBLIQUITY.

down to act as buttresses for the support of distorted parts, and occasionally the whole of both the external and the internal aspect of the bones are covered with small spine-like protuberances.

The sacrum is sunk deeply between the iliac bones, being displaced forwards and downwards by the body-weight, and is at the same time rotated forwards on its transverse axis, so that the sacral promontory projects disproportionately at the pelvic brim, causing great shortening of the conjugata vera, and often giving the inlet a reniform outline. Its lateral halves, moreover, are often somewhat unequal. The upper two-thirds of the bone are almost straight, and are directed nearly horizontally backwards, but the lower third is bent sharply forwards, and makes an obtuse angle with the upper portion, so that the vertical curvature as a whole is increased. The general rotation of the sacrum prevents the lower part from causing an obstruction at the outlet. The normal transverse curvature is absent, and the front of the bone is flat, or even slightly convex, from side to side, due to the bodies of the sacral vertebræ being displaced further forwards than the lateral portions, which are anchored in position by the ligaments binding them to the ilium. Frequently, also, that portion of the ilium, which lies on each side of the sacrum and bounds the postero-lateral portion of the true pelvis, is pushed forwards by the pressure of the lateral masses of the sacrum, and forms a rounded angle with the anterior part of the os innominatum above the great sciatic notch. In these cases, the reniform shape of the inlet already referred to is very evident.

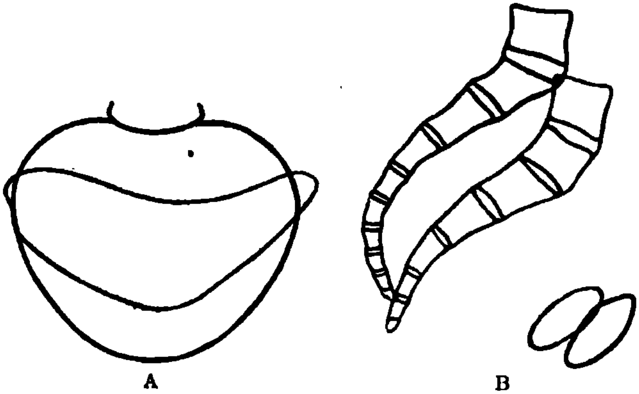

FIG. 310.—THE RACHITIC FLAT PELVIS. EXTREME DEGREE

A, Outline of brim; B, sagittal section. (Outline of normal pelvis in black, of contracted pelvis in red.)

The lessening of the inward pressure exerted by the heads of the femora upon the ossa innominata, together with the excessive formation of cartilage in these bones, enables the body-weight to manifest itself more effectively, and consequently the bones present an excessive degree of outward curvature. The transverse diameter of the brim is therefore increased relatively to the conjugate, but, in many pelves, though relatively increased, it is actually diminished, as a result of the general mal-development produced by the rickets.

Other results of the excessive bending of the innominate bones are an unusual prominence of the anterior parts of the ilio-pectineal lines, and a flattening of the bodies of the pubic bones so that they become almost straight from side to side. The pubic arch also is greatly widened. The conjugate diameter, which has been seen to be much shortened at the inlet, undergoes an immediate and considerable increase in length below the brim, on account of the curvature and position of the sacrum. At the outlet, it again undergoes some diminution, but not to any marked extent, and this diameter may be even longer than in the normal pelvis.

The tubera ischii are widely separated and somewhat everted, partly due to the curvature of the innominate bones, and partly to the pull of the adductor muscles of the thigh. The transverse diameter is therefore widened at the outlet. The general result of these changes is to produce a pelvis flattened at the brim, and increasing in capacity from above downwards in both the conjugate and transverse directions.

In the false pelvis, the iliac fossæ are flatter and more vertical than normal, and look almost directly forwards. The curvature of the iliac crest is diminished, probably owing to a persistence of the infantile type, and the anterior superior iliac spines are directed rather outwards than forwards, so that the distance between them is as great, or even greater, than between any other corresponding points on the crests. In consequence of the position of the sacrum, the posterior iliac spines approach one another closely.

Symptoms.—The special symptoms of flat pelvis differ to some extent from those of generally contracted pelvis. They will be discussed under the same headings as in the former case.

(1) Effect on the Relation of the Head to the Brim.—In the early months of pregnancy there is an increased liability to the occurrence of incarceration of a retroverted uterus, in consequence of the manner in which the sacral promontory overhangs the pelvic cavity. As the degree of narrowing of the conjugate is usually considerable, the presenting head is unable to adapt itself to the pelvic brim as in normal cases, and consequently during pregnancy the uterus is pushed upwards out of the pelvic cavity. As a result of this, pendulous abdomen and malpresentations are common during the latter part of pregnancy. During labour, for the same reason, the head is unable to fill the lower uterine segment, and premature rupture of the membranes, sudden and

complete escape of the liquor amnii, and consequent slow dilatation of the uterine orifice, are the rule.

(2) Effect on the Fœtus.—The caput succedaneum is of large size, though it does not reach the dimensions that it usually reaches in cases of generally contracted pelvis. At first, it forms in the region of the anterior fontanelle, and then travels backwards over the surface of the anterior or posterior parietal bone, according as one or other presents. The moulding of the head is not as great as in generally contracted pelvis, although the actual pressure on the head is perhaps greater. This can be readily understood, if we remember that in generally contracted pelvis pressure is exerted on the head uniformly all round by the brim, while, in flattened pelvis, the pressure is mainly exerted on two points of the head by the promontory and the symphysis. In consequence, in the former case there is a tendency for an exaggerated degree of the normal process of moulding to occur, while, in the latter case, the tendency is rather to the occurrence of dinting of the bone which is in relation to the promontory. In this way, the posterior parietal bone is flattened, and, in the greater degrees of contraction, a large spoon-shaped or funnel-shaped depression may be found on it, or even fracture of the bone may occur. In the lesser degrees of contraction, a gutter-shaped groove is found running parallel with the sagittal suture. In the case of an after-coming head, this groove runs from the anterior inferior angle of the parietal bone upwards and backwards towards the parietal eminence.

(3) Effect on the Mechanism of Expulsion.—The alterations which are met with in the normal mechanism of a vertex presentation in flattened pelvis are due to two things:—First, to the obstruction offered to the descent of the bi-parietal diameter of the head; and, secondly, to the resistance of the promontory. The obstruction offered to the descent of the bi-parietal diameter results in an alteration in the presentation and in the relation of the head to the brim. In consequence of the narrowed conjugate, the head is unable to engage in the ordinary manner with its antero-posterior diameters corresponding to one or other oblique diameter of the brim, and is forced instead into a transverse position, where it lies with a diameter slightly anterior to the sub-occipito-bregmatic diameter, corresponding to the transverse diameter of the brim. In this position, the bi-parietal diameter is slightly to one side of the conjugate, but is still prevented from descending by the pelvic contraction. The anterior part of the head is, however, free to descend, and, as it is driven downwards by the contraction, the head becomes slightly extended, with the result that a diameter which approximately corresponds to the occipito-frontal diameter comes to lie in the transverse diameter of the pelvis, and that the anterior fontanelle constitutes the presenting point. At the same time, the entire head glides laterally towards the side of the pelvis to which the occiput

points, and thus brings the bi-parietal diameter into the lateral sweep of the brim, where there is more room for it, and also brings the smaller bi-temporal diameter into the conjugate. The effect of these changes is that the head presents at the brim with the fronto-occipital diameter corresponding to the transverse diameter of the pelvis and the bi-temporal diameter to the conjugate diameter, and the anterior fontanelle lowest. At a similar stage in a normal pelvis, a diameter slightly anterior to the sub-occipito-bregmatic diameter corresponds to one oblique diameter of the pelvis and the bi-parietal diameter to the opposite oblique, and the vertex lies lowest. The resistance of the promontory brings about a further alteration in the relation of the head to the brim. On account of the manner in which the promontory projects into the brim, the resistance offered to the descent of the part of the head which lies in contact with it, *i.e.*, the posterior parietal bone, is greater than the resistance offered to the part of the head in contact with the symphysis, *i.e.*, the anterior parietal bone. In consequence, the latter descends more rapidly, the head rotates round its antero-posterior diameter, the sagittal suture approaches the promontory, and the anterior parietal bone lies lowest. This position of the head is known as posterior asynclitism, presentation of the anterior parietal bone, or Naegele's obliquity. In cases of great contraction, the sagittal suture may move round almost into contact with the promontory, and the ear replace the anterior fontanelle as the presenting point—a so-called ear presentation. In practice, we recognise that the extent to which Naegele's obliquity occurs is an indication of the degree of contraction present, and that, if the sagittal suture comes within half an inch of the promontory, it is impossible for the head to be born (Litzmann*). If, on the other hand, the degree of contraction is not too great, the anterior parietal bone becomes fixed behind the symphysis, and the head rotating round it as a fixed point, the posterior parietal bone is squeezed past the promontory, by which it is dinted or grooved to a varying extent. At the same time, the occiput passes through the brim, and once this has occurred the remaining mechanism of the case is similar to that in a normal pelvis, as the diameters of the cavity and outlet are usually unaffected in flattened pelvis.

Anterior asynclitism of the head, or presentation of the posterior parietal bone, or Litzmann's obliquity, as it is variously termed, may occur in a few cases, instead of posterior asynclitism. Such a condition is rare, and when it does occur will usually prevent the passage of the head. The mechanism, which is said to occur in the few cases in which delivery takes place, was described when discussing anterior asynclitism of the head.

In the case of the after-coming head, a mechanism very similar to that just described must be followed. It is important to remember this, in order that when delivering the head we may make the latter follow such a mechanism. The after-coming head must pass through the brim in a transverse position, the occiput as far to one or other side as it will go, and flexion at first not too marked. Efforts at jaw traction may tend to cause too great a degree of flexion, and it is perhaps for that reason that Martin's method, in which delivery is effected by pressure through the abdominal walls, is found to be superior in these cases to Smellie's method. In Martin's method, the degree of flexion can be regulated, while in Smellie's method flexion is of necessity as complete as the resistance to the descent of the head will allow.

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* 'Die Geburt bei engen Becken,' Leipzig, 1884.

(4) Effect on the Uterus and Vagina.—In a flattened pelvis, the head does not fill the brim in the same complete manner as is the case in the generally contracted pelvis, but rather is in contact with it at two points only—the sacral promontory and the back of the symphysis. In consequence, œdema of the vagina and vulva is not as commonly met with as in generally contracted pelvis. On the other hand, rupture of the uterus, either in the thinned lower uterine segment or by rubbing through of the portion nipped between the head and the two points of contact with the pelvis, is more common.

Diagnosis.—The diagnosis of flattened pelvis is made by finding that the conjugate diameter of the brim is diminished, while the other diameters are normal in length.

Treatment.—In contraction of the first degree, we have a choice between allowing the head to mould through the brim, and performing prophylactic version. As the degree of contraction is slight, the former method offers the best prospect of success, and should be adopted unless there is some reason to suppose that the head is above the normal size, in which case prophylactic version may be preferable. If the former course is adopted, the moulding of the head through the brim must be left to the natural efforts so long as it is possible to do so consistently with the safety of the mother, or until the fœtus dies. If danger-signals on the part of the mother appear, an attempt may be made to extract the fœtus with the forceps; and, if the fœtus dies during labour, perforation may be performed in order to save the mother from unnecessary suffering. So long as the head remains above the brim, the forceps is contra-indicated, as it interferes with the mechanism peculiar to flattened pelvis, and, moreover, tends to increase the lateral and antero-posterior diameters of the head, as has been shown. Once the head has passed the brim, the forceps may be applied, if it is necessary to do so.

In the second degree of pelvic contraction, the induction of premature labour is the best line of treatment. If the patient is not seen sufficiently early in pregnancy for this to be done, prophylactic version offers the best prospect of saving the fœtus, unless we perform symphysiotomy or Cæsarean section. In this degree, the probability of the head moulding through the brim is too unlikely to render it a suitable treatment to adopt. Prophylactic version, on the other hand, if performed by a skilful obstetrician, offers a fair prospect of success. As has been already mentioned, Martin's method offers the best means of delivering the after-coming head. The latter must be brought through the brim with its antero-posterior diameter corresponding to the transverse diameter of the brim, with the occiput as close as possible to the side of the brim towards which it is turned, and without an undue degree of flexion. At the same time, care must be taken not to allow the chin to catch above the side of the brim, as if that occurred the prospect of delivering the fœtus alive would be very small. As soon as the brim is passed, the face is rotated posteriorly and the degree of flexion may be increased. The remainder of the delivery of the head is similar to that in a normal pelvis. If the patient is not seen until too late in labour to perform version, there is as a rule nothing to be done save to perforate, or, if the circumstances are favourable, to perform symphysiotomy. Attempts to extract with the forceps in the case of a head of normal size are inadmissible, on account of the danger to the mother.

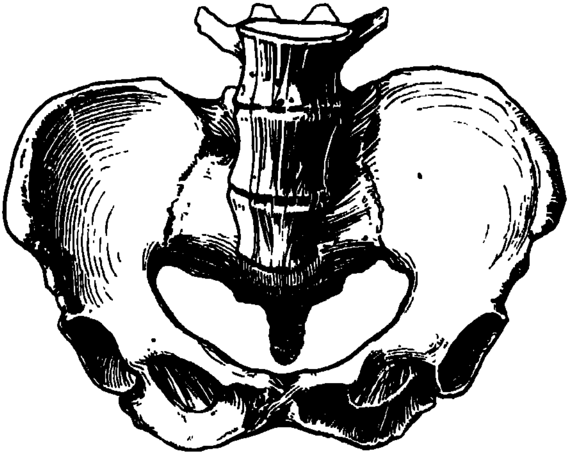

FIG. 311.—THE FLATTENED PELVIS. RACHITIC GENERALLY CONTRACTED FLAT PELVIS.

THE GENERALLY CONTRACTED FLAT PELVIS.—The essential feature of the generally contracted flat pelvis is contraction of all the diameters of the brim, especially marked in the true conjugate, which is diminished out of proportion to the other diameters. This form of contraction includes two varieties, the simple or non-rachitic generally contracted flat pelvis, and the rachitic generally contracted flat pelvis.

The Non-Rachitic Generally Contracted Flat Pelvis. — This variety is the rarer of the two. It resembles a justo-minor pelvis in which the sacrum has become depressed into the pelvic cavity, with consequent diminution of the conjugate diameter out of proportion to the diminution of the other diameters. It is probably the result of causes similar to those which produce a justo-minor pelvis, and can be distinguished from the rachitic variety by the absence of deformity of the sacrum. Occasionally flattening, with general contraction, results from faulty development of the os innominatum, without sacral displacement. The anterior portion of this bone remains shorter than normal, possibly due to premature osseous union with the posterior part, and consequently leads to antero-posterior contraction. The transverse diameter also is short, because the early ossification prevents the development of the normal curves of the bones.

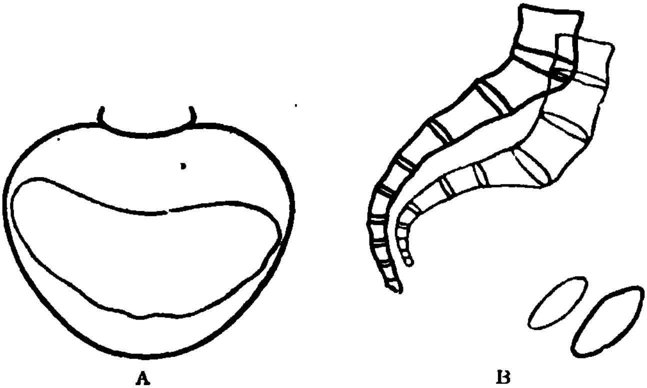

FIG. 312.—THE RACHITIC GENERALLY CONTRACTED FLAT PELVIS.
A, Outline of brim; B, sagittal section. (Outline of normal pelvis in black, of contracted pelvis in red.)

The Rachitic Generally Contracted Flat Pelvis.—This variety is comparatively common, but does not require any lengthy description, because it is almost identical in appearance with the flat rachitic pelvis, except that there is more general contraction. It is the result of rachitis of a more severe type than that which leads to the flat rachitic pelvis, and which is responsible not only for the flattening, but also for the pronounced arrest of development of the bones which leads to general contraction. The sacrum is deformed and displaced, and the bones are characteristically rickety. It is, as would be expected, most commonly found in small women.

Symptoms.—The symptoms of generally contracted flat pelvis are perhaps more marked than are those of either of the forms with which we have so far dealt, and are—as is natural composed of those peculiar to both these forms.

(1) Effect on the Relation of the Head to the Brim.—In this form of pelvis, the brim is somewhat triangular in shape, and the degree of contraction is often considerable. The head is found completely above the brim at the commencement of labour, and, consequently, pendulous abdomen is the rule and malpresentations are very common. Even when the head enters the brim, it does not fill the latter, nor can it descend into and fill the lower uterine segment; consequently, premature rupture of the membranes and complete escape of the liquor amnii are the rule.

(2) Effect on the Fœtus.—As the head usually enters the brim in a flexed position, the caput succedaneum forms in the region of the posterior fontanelle, and attains a large size. Considerable moulding of the head occurs, and marked dinting and grooving of the posterior parietal bone are even more common than in flat pelvis.

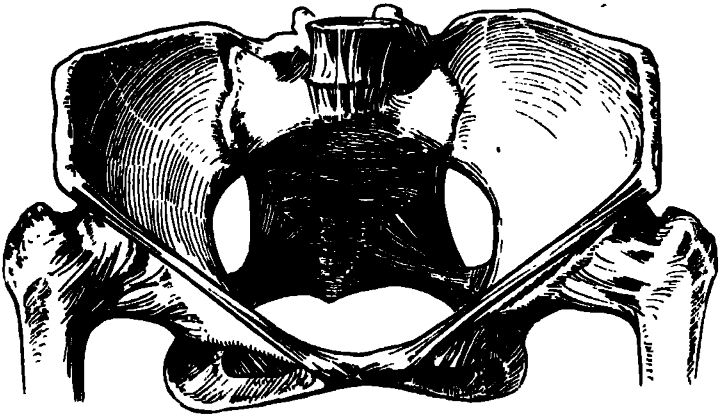

FIG. 313.—PELVIS OF CONGENITAL DISLOCATION OF THE HIPS.

(3) Effect on the Mechanism of Expulsion.—The effects on the mechanism of expulsion of the general contraction and of the flattening of the brim are very obvious. The head enters the brim in a degree of flexion proportionate to the degree of general contraction, and usually with the sub-occipito-bregmatic diameter corresponding to the transverse diameter of the pelvis. Naegele's obliquity or posterior asynclitism usually occurs, but in some cases —one-fifth (Winckel)—anterior asynclitism may be met with. Internal rotation occurs later than usual, and the head may even emerge in an oblique or transverse position. This, and the fact that delivery is usually rapid once the head has passed the brim, are due to the increase which occurs in the diameters of the

pelvic cavity in this variety of contraction on account of the divergence of the pelvic walls.

(4) Effect on the Uterus and Vagina.—Laceration of the cervix, rupture of the lower uterine segment, or rubbing through of a nipped portion of the uterine wall, are especially common in this form of contraction.

Treatment.—The treatment of generally contracted flat pelvis is in the main similar to that of generally contracted pelvis. Inasmuch as the posterior fontanelle presents at the brim, the application of the forceps in contraction of the first degree, when the head fails to mould through the brim, may have a better chance of success than it has in flat pelvis, while, on account of the general contraction, extraction of the after-coming head after prophylactic version is usually difficult.

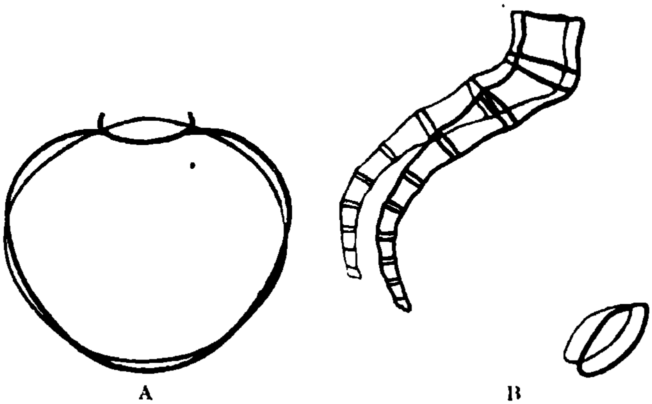

FIG. 314.—PELVIS OF CONGENITAL DISLOCATION OF THE HIPS.

A. Outline of brim; B, sagittal section. In this specimen there is no noticeable flattening. (Outline of normal pelvis in black, of contracted pelvis in red.)

THE PELVIS OF CONGENITAL DISLOCATION OF THE HIPS.—The form of pelvis met with in the condition which is usually termed double congenital dislocation of the hips is one which, from a developmental point of view, is of extreme interest, although it gives rise to only slight difficulty during labour. It is a rare form of pelvic contraction.

In cases of congenital dislocation of the hips, the heads of the femora most commonly articulate with the dorsum ilii above and behind the region of the acetabula, and at the same time are placed farther apart than is normal. The resultant changes in the pelvis are caused, firstly, by the transmission downwards of the body-weight along a more posterior plane than normal, and, secondly, by the altered action of the various groups of muscles attached to the pelvis and femora, owing to the change in the level of their attachment and of their direction.

Owing to the position of the femora, the anterior support of the pelvis is removed, and is replaced by a force which tends to drive the posterior half-ring of the pelvis upwards, and to increase the pelvic obliquity. At the same time, the pull of the ilio-femoral ligaments and of the ilio psoas muscles tends to displace the anterior part of the pelvis backwards, and thus still further to increase the obliquity. The extent of the action of the ilio-psoas in this direction is shown by the depth of the groove which the muscle hollows out on the ilium behind Poupart's ligament, where it plays against the bone.

The increase of pelvic inclination causes a greater proportion of the body-weight than normal to exert its action along the plane of the inlet, and this, combined with the want of anterior support, results sometimes in a depression of the promontory of the sacrum, and consequently causes a moderate degree of flattening at the brim. The vertical curvature of the sacrum is somewhat increased, and the coccyx projects downwards into the pelvis, but since it is at the same time rotated upwards, the conjugate diameter of the outlet is not diminished in length, and even may be increased.

The absence of inward pressure against the acetabula causes the normal curvature of the os innominatum to become accentuated, and thus leads to slight increase of the transverse diameter at the inlet. The transverse diameter of the outlet is also widened, but in a more marked degree, the tubera ischii being pulled forwards and outwards by the muscles attached to them, while at the same time the sub-pubic angle is enlarged. The upward thrust of the femora posteriorly, in addition to producing increased pelvic obliquity, causes the venter ilii on each side to assume an almost vertical position, and frequently the crest may be seen projecting outwards under the skin. The bones of the posterior part of the pelvis are dense and large, in consequence of the increased pressure which is thrown upon them. On the other hand, the anterior part of the pelvis, which has little weight to sustain, is thin and slender.

Patients, who are the subjects of this deformity, can be readily recognised by the marked lordosis of the lumbar and lower dorsal vertebræ—a lordosis which is developed compensatory to the great pelvic obliquity, and by the fact that the abdomen lies on a plane anterior to the anterior aspect of the thighs. If congenital dislocation exists on one side only, an oblique deformity of the pelvis is produced.

Diagnosis.—The diagnosis can frequently be made from the waddling manner in which the patient walks, resembling the mode of progression of a duck. On examination of the pelvis, when the patient is lying down, the great trochanter of the femur will be found above Nélaton's line, *i.e.*, the line joining the anterior superior spine and the tuberosity of the ischium on the same side. Under ordinary circumstances, this line touches the top of the trochanter.

Treatment.—The degree of contraction met with in this pelvis is not as a rule sufficiently great to interfere with the normal progress of labour. If, however, the contraction is greater than usual, the case is treated in a similar manner to a flat pelvis.

CHAPTER IV

THE RARE FORMS OF CONTRACTED PELVIS

Obliquely Distorted Pelvis—The Kypho-scoliotic Pelvis—The Coxalgic Pelvis—The Synostotic Pelvis. The Transversely Contracted Pelvis—The Bilateral Synostotic Pelvis—The Kyphotic Pelvis. The Funnel-shaped Pelvis. The Irregularly Compressed Pelvis—The Osteo-malacic Triradiate Pelvis—The Rachitic Triradiate Pelvis. The Spondylolisthetic Pelvis. Pelvis Deformed by Tumours, Fractures, and Dislocations. Split Pelvis. Pelvis Justo-major.

In the previous chapter, we have referred to certain of the rare varieties of contracted pelvis—viz., the generally contracted rachitic pelvis, the dwarf pelvis, the generally contracted flat non-rachitic pelvis, and the pelvis of congenital dislocation of the hips, because the nature of the deformity in these cases and the effect on labour are almost identical with the nature and the effects of the common varieties of contraction. In the following chapter, we shall discuss the remaining classes of contracted pelvis, all of which are of rare occurrence.

According to the classification we have adopted, we have still to deal with the following classes:—

III. Obliquely Distorted Pelvis.
  (1) By spinal curvature—kypho-scoliotic pelvis.
  (2) By imperfect or abolished use of one limb—coxalgic pelvis.
  (3) By asymmetry of the sacrum—unilateral synostotic pelvis, Naegele's pelvis.

IV. Transversely Contracted Pelvis.
  (1) Bilateral synostotic pelvis, Robert's pelvis.
  (2) The kyphotic pelvis.

V. Funnel-shaped Pelvis.

VI. Compressed or Triradiate Pelvis.
  (1) The osteo-malacic pelvis.
  (2) The rachitic pelvis.

VII. Spondylolisthetic Pelvis.

VIII. Pelvis Narrowed by Exostoses, Fractures, and Bony Tumours.

IX. Split Pelvis.

Obliquely Distorted Pelvis.

An obliquely distorted pelvis is one in which there is a deviation of a part of or the whole pelvis towards one or other side, in such a manner that a marked difference exists in the respective lengths of the oblique diameters.

Varieties.—Three varieties of oblique distortion are met with, each of which is produced by a different cause. These are :—

(1) By spinal curvature—kypho-scoliotic pelvis.
(2) By imperfect or abolished use of one limb—coxalgic pelvis.
(3) By asymmetry of the sacrum—unilateral synostotic pelvis, Naegele's pelvis.

Frequency.—Oblique distortion of the pelvis is a rare deformity in these countries. According to Winckel's statistics, it occurs in two per cent. of cases of pelvic deformity. The kypho-scoliotic pelvis is the commonest of the three varieties.

Ætiology and Characteristics.—In all these varieties of oblique contraction, one important factor in producing the obliquity is constant, and consists in the unequal transmission of the body-weight through the lower limbs, whereby the effect of pressure from above and counter-pressure from below manifests itself during the period of growth to a greater extent upon one os innominatum than upon the other, and thus, by leading to unequal curvature of the two bones, gives rise to oblique deformity. Important differences, however, exist in the different varieties, because in one—the oblique synostotic pelvis—the primary obliquity is due to abnormal development or pathological change in the pelvis itself; while in the other two varieties, which, indeed, might be grouped together, the obliquity is entirely secondary to the effects of pressure unequally transmitted to the lower limbs owing to changes which have occurred outside the pelvis. In all varieties, the following defects can be noted :—

(1) One oblique diameter is shorter than the other.

(2) The conjugate diameter deviates from the sagittal plane.

(3) The ala of the sacrum on the side of greater pressure is imperfectly developed, and the curvature of the os innominatum on the same side is diminished, while the curvature of the other os innominatum is increased.

(4) The pelvic cavity is divisible into a narrow part, towards which the sacral promontory is directed, and into a wide part, bounded in front by the symphysis pubis.

THE KYPHO-SCOLIOTIC PELVIS.—This is the commonest variety of obliquely contracted pelvis. It is the result of a scoliosis or lateral curvature of the vertebral column; and, since rickets in early life is the most common cause of this, the oblique distortion is often associated with some degree of flattening and other rachitic changes. The convexity of the lateral curvature is most often directed to the right side in the dorsal region, and is compensated by a left-sided lumbar scoliosis, which causes the left lower limb and the left side of the pelvis to be overweighted. As a result of this the promontory of the sacrum is deviated to the same side as the convexity of the lumbar curve, and the lateral mass of the sacrum on the same side is smaller than normal, even the anterior sacral foramina on the overweighted side being diminished in size. The articular surface also is displaced downwards and forwards upon the ilium, while, as a rule, the long axis of the sacrum is directed towards the sound side.

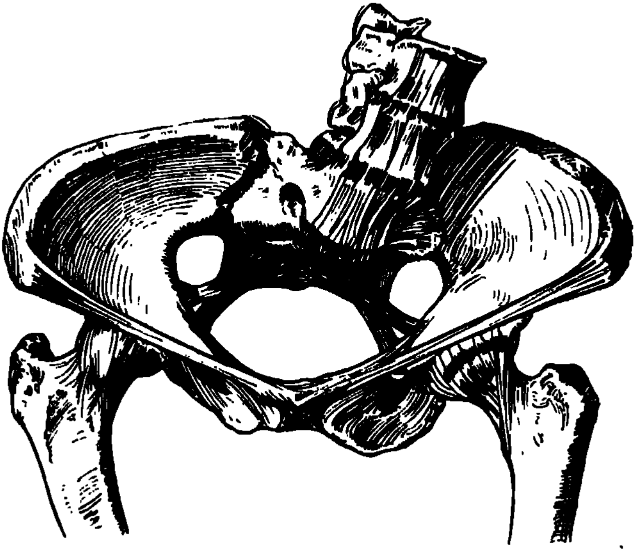

FIG. 315.—OBLIQUE DISTORTION OF THE PELVIS. THE KYPHO-SCOLIOTIC PELVIS.

The disproportionate muscular development of the overweighted side causes the inward thrust of the head of the femur against the acetabulum to be increased in force, and, by hindering the development of the normal curvature of the os innominatum, brings about a still further approximation of the acetabulum to the sacro-iliac joint, the latter, as we have already seen, being itself displaced forwards upon the ilium. Characteristic features therefore, in all these cases, are marked shortening of the space between the sacro-iliac joint and the acetabulum, and the smallness of the great sciatic notch on the side of the lumbar scoliosis. Indeed, if the bones have been rendered pliable by rickets, the pressure of the femur may cause a marked angular bend of the os innominatum posteriorly at its weakest place, where it bounds the great sciatic notch above, and thus convert the above-mentioned interval into a passage so narrow as to prevent the entrance of any part of the fœtus. The anterior part of the os innominatum always maintains an almost straight course.

Another effect of the increased pressure of the femur is that the symphysis pubis is driven over towards the opposite side. This displacement is aided by the fact that, as the healthy os innominatum is hollowed out, it exerts a pull upon the symphysis, and this pull is not counterbalanced in the ordinary way by the development of a corresponding curvature in the other bone. This latter force, moreover, is greater than normal, since the underweighted os innominatum becomes excessively curved, owing to the diminution of the inward thrust of the femur on that side. In this way, the symphysis pubis is pushed and pulled towards the sound side, and comes to subtend anteriorly a wide hollowed-out portion of the pelvic cavity, while the conjugata vera becomes correspondingly displaced from the mesial plane. The oblique diameter on the overweighted side is considerably longer than its fellow, and the antero-posterior diameter drawn in the mesial plane of the body is much diminished in length. Amongst other results of the pressure distribution, we may notice that the overweighted ilium projects further back, and is situated at a higher level than the opposite ilium, the distance from its posterior superior spine to the spines of the sacrum being also diminished as compared with the sound side. The entire bone has, in fact, slipped upwards and backwards upon the ala of the

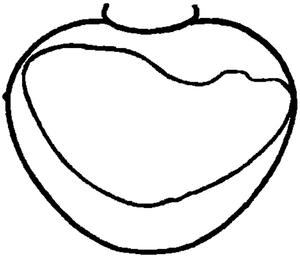

FIG. 316.—THE KYPHO-SCOLIOTIC PELVIS.

Outline of brim. (Outline of normal pelvis in black, of contracted pelvis in red.)

sacrum. Its structure is abnormally compact, on account of the increased weight which it has to sustain, and the muscles in relation to it are hypertrophied. The venter ilii on the affected side is unusually flat, lies almost vertically, and it is directed more inwards than forwards. The opposite os innominatum, on the other hand, is abnormally slender, and the muscles and ligaments in relation to it are poorly developed.

THE COXALGIC PELVIS.—This term is applied to a pelvis which has become obliquely deformed as a result of unequal lateral pressure due to imperfect or abolished use of one lower limb.

The most common morbid causes of the condition are tubercular disease of the hip-joint, some variety of unilateral talipes, or congenital shortening of one leg. Early amputation of one lower limb may produce a similar result.

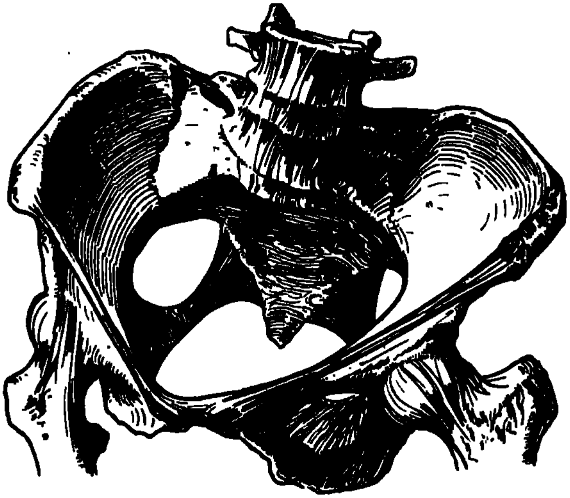

FIG 317.—OBLIQUE DISTORTION OF THE PELVIS. THE COXALGIC PELVIS. Note the diseased condition of the right hip-joint.

In cases in which one limb is shorter than the other, but is still capable of being used, the pelvis will be tilted downwards on the diseased side in a compensatory manner, and thus increased weight will be thrown upon the shortened limb. In consequence of this, changes take place in the pelvis exactly similar to those which have been described in the kypho-scoliotic pelvis. Moreover, scoliosis of the lumbar vertebræ, with the convexity directed towards the diseased side, almost invariably occurs, and contributes to the general effect. The ala of the sacrum on the diseased side remains small, and is driven downwards and forwards into the pelvis. The innominate bone on the same side is unable to develop its normal degree of curvature, and remains almost straight from before backwards; while its fellow becomes excessively curved, and pulls the symphysis pubis over towards the healthy side, towards which side, in consequence, the conjugate diameter is directed. The oblique diameter of the diseased side is contracted, and the opposite oblique diameter is lengthened.

If, however, the use of one lower limb is entirely abolished, the exactly opposite variety of obliquity occurs. In these cases, all the weight of the body is necessarily transmitted through the sound limb, the muscles and bones of which become much hypertrophied. The os innominatum on the diseased side is excessively hollowed out, and the symphysis pubis is displaced towards that side. The bones also on the diseased side are slender, especially in front, and the venter ilii may be more vertical than usual.

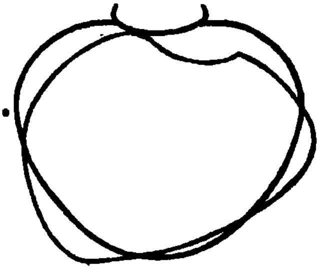

FIG. 318.—THE COXALGIC PELVIS.

Outline of brim. (Outline of normal pelvis in black, of contracted pelvis in red.)

The oblique diameter on the sound side is diminished, and the opposite oblique diameter is lengthened. It is only in rare instances that more than a very minor degree of obliquity is produced by any form of coxalgia.

THE UNILATERAL SYNOSTOTIC PELVIS, OR PELVIS OF NAEGELE.—The distinguishing and characteristic feature of this pelvis is ankylosis of the sacrum with the ilium on one side, and almost complete atrophy of the lateral mass of the sacrum on the same side.

The actual cause of this ankylosis is different in different cases. In the majority, it is probably due to a congenital and unilateral failure of the centres of ossification from which the lateral part of the sacrum is normally developed. This causes a pronounced and unilateral narrowing of the sacrum, and excessive pressure is therefore thrown upon the deformed side. This pressure displaces the sacrum downwards and forwards on that side, and ultimately is responsible for the occurrence of synostosis by the atrophy which it occasions in the joint surfaces. In other cases, it is probable that the sacrum in the first instance becomes slightly displaced forwards on one side, as a result of injury, and then becomes ankylosed in its new position, thus preventing further lateral development. In a few cases, inflammation of the sacro-iliac joint may be the cause of both displacement and synostosis.

The ankylosis generally takes place in early life, and therefore leads to considerable pelvic deformity. Should it occur at a later period, but before the skeleton has completed its development, a lesser degree of distortion is the result.

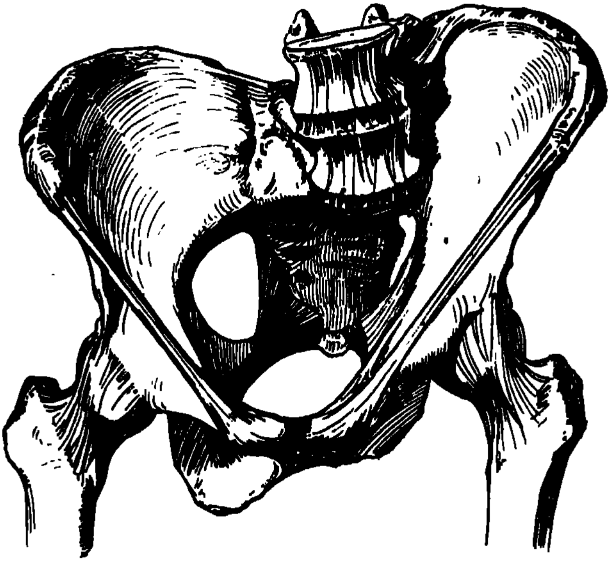

FIG. 319.—OBLIQUE DISTORTION OF THE PELVIS. THE UNILATERAL SYNOSTOTIC OR NAEGELE'S PELVIS.

The unequal transmission of the body-weight is the mechanical result of the fact that the distance from the middle of the base of the sacrum to the sacro-iliac articulation on the diseased side is less than the distance between the two similar points on the sound side, and that therefore more pressure is brought to bear upon the diseased side, the muscles and ligaments of which become proportionately hypertrophied. The inward thrust of the head of the femur is therefore increased on the ankylosed side, and, at the same time, the ankylosis renders the leverage exerted by the outward pull of the sacro-iliac ligaments entirely nugatory, although the growth of the os innominatum itself is not interfered with.

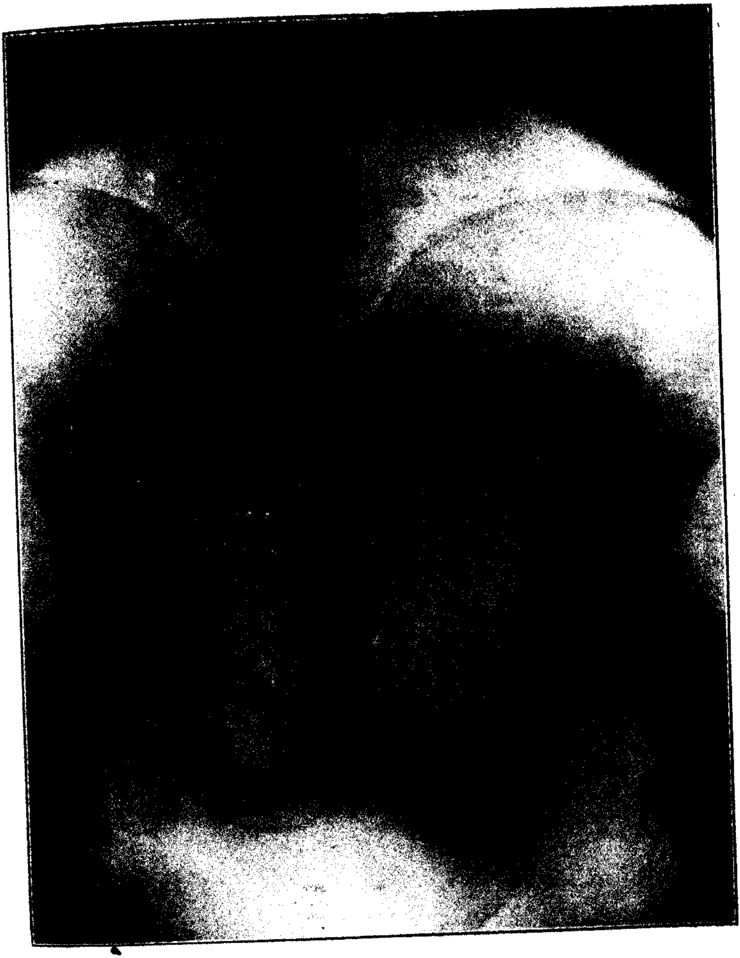

PLATE IX.—SKIAGRAM OF A UNILATERAL SYNOSTOTIC OR NAEGELE'S PELVIS.

Note the absence of the right sacro-iliac joint, and of the right lateral mass of the sacrum. (From a skiagram taken by Dr. W. S. Haughton of a patient who was confined in the Maternity Ward of Dr. Steevens' Hospital.)

[*To face p.* 766.

The general result of these changes is similar to that which has been already described in the other forms of oblique pelvis, but the oblique distortion is usually much more pronounced. The promontory of the sacrum is depressed and driven forwards on the diseased side, and the front of the sacrum looks towards the same side. The ankylosed os innominatum is almost straight from before backwards, and is displaced upwards. The transverse diameter of the pelvis is shortened throughout the whole extent of the cavity, but especially at the outlet by the inward and backward projection of the tuber ischii. The ischial spine on the diseased side forms a marked inward projection.

The healthy os innominatum is comparatively slender, and is hollowed out into a marked concavity, especially at its anterior part. The symphysis pubis is drawn over to the sound side and subtends the wider division of the pelvic cavity, so that the shape of the inlet becomes that of an obliquely placed oval, the long diameter of which approximately corresponds to the oblique diameter drawn from the synostosed sacro-iliac joint to the opposite acetabulum, and which is cut transversely by the opposite and shortened oblique diameter. The conjugata vera is often slightly increased in length. The venter ilii on the diseased side is almost vertical. It is flat, and looks almost directly inwards, while the posterior superior iliac spine overlaps the back of the sacrum, and approaches very close to the middle line of the back.

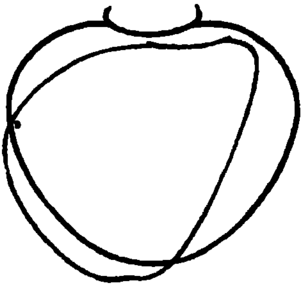

FIG. 320.—NAEGELE'S PELVIS.

Outline of brim. (Outline of normal pelvis in black, of contracted pelvis in red.)

Some slight scoliosis in the lumbar region is usually present, the convexity of the curve being directed towards the diseased side.

Symptoms.—The symptoms of oblique distortion of the pelvis are those common to all forms of contraction. Their intensity depends upon the degree of contraction present, and this is estimated not by the length of the conjugate diameter, as in the varieties of contraction with which we have dealt, but by the length of the shorter of the two oblique diameters.

When the degree of distortion is not such as to prevent the passage of the head, the latter usually engages with its sagittal diameter corresponding to the long oblique diameter of the pelvis —*i.e.*, that running from the sacro-iliac joint on the deformed side to the opposite pectineal eminence. If, however, the distortion is extreme and the sacro-cotyloid distance on the deformed side is so short that the head cannot pass into that portion of the pelvic cavity which lies behind it, the oblique diameter on the deformed side, though actually the longer, is practically the shorter. In such a case, the pelvis for practical purposes assumes the form of the generally contracted pelvis, and the mechanism of labour is similar (Spiegelberg). The head enters the brim in a position of marked flexion, its sagittal suture running obliquely or transversely. The further progress of the case depends on whether the degree of contraction increases or diminishes towards the outlet. The passage of the head at the outlet is easiest when the sagittal suture corresponds with the anatomically shorter oblique diameter, as the obliquity tends to become reversed towards the outlet. An after-coming head, however, passes more easily through the pelvis when the occiput is directed towards the wide side of the pelvis (Spiegelberg).

Diagnosis.—Inspection of the patient will, as a rule, show that the sides of her body are asymmetrical, and a vaginal examination, if carefully made, will enable the unilateral flattening of the pelvis to be recognised. External measurements show that the iliac bone on one side is higher than normal, and that consequently one anterior superior spine lies on a higher level than does the other; that the iliac crest rises higher on one side than on the other; that the posterior superior spines are unequally distant from the middle line; and that one spine projects further backwards than does the other (Spiegelberg*). Internal examination and measurements show that the pubic arch is directed somewhat to one side instead of straight forward; that one horizontal pubic ramus does not bulge as far forward as is normal; and that the corresponding ilio-pectineal line is more or less straightened, while the promontory can only be reached with difficulty, if at all. When the promontory can be reached, it appears to deviate from the middle line, and not to face the symphysis (Spiegelberg). The condition of the pelvis is most likely to attract attention in the case of a kypho-scoliotic or coxalgic pelvis, on account of the obvious lesions that are present in the spinal column, the hip-joint, or the lower limb. The Naegele pelvis due to disease of, or in the neighbourhood of, the sacro-iliac joint can be recognised by the following measurements given by Naegele† for the purpose:—

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* *Op. cit.*, vol. ii., p. 102.

† 'Das Schräg Verengte Becken,' Maintz, 1839.

(1) The distance from the ischial tuberosity on the deformed side to the posterior superior spine on the opposite side is shorter than its fellow.

(2) The distance from the anterior superior spine on the deformed side to the spinous process of the last lumbar vertebra is shorter than its fellow.

(3) The distance from the anterior superior spine on the deformed side to the posterior superior spine on the opposite side. is shorter than its fellow.

(4) The distance from the great trochanter on the deformed side to the posterior superior spine on the opposite side is shorter than its fellow.

(5) The distance from the posterior superior spine on the deformed side to the lower edge of the symphysis is longer than its fellow.

Spiegelberg considered that these measurements are not of any great value in cases of slight deformity, and that in cases of considerable deformity a diagnosis is best arrived at by introducing the hand into the vagina, and noting the distances between the apex of the sacrum and the ischial spines on each side, and between the middle of the promontory and the upper and posterior portion of the floor of the acetabulum (the sacro-cotyloid distance) on each side.

Treatment.—If the degree of contraction is slight, the head may mould successfully through the pelvis. If it fails to do so, perforation must be performed. Spiegelberg particularly warned us against the application of the forceps or the performance of version under any circumstances. If the case is seen sufficiently early, and if the degree of narrowing is not very great, premature labour should be induced. In other cases, Cæsarean section should be performed at term.

Prognosis.—To judge by Litzmann's statistics, the prognosis in this form of contraction is very serious for both mother and fœtus. According to this writer, out of 28 mothers, 22 died during their first confinement; out of 41 labours, only 6 passed off spontaneously, and of these 5 were in the same individual; out of 41 children, only 10 were born alive, and of these 6 had the same mother. These figures cannot, however, hold good for the present day, save in cases in which the existence and degree of the contraction are not recognised, as Cæsarean section is usually clearly indicated, and will yield a very much reduced mortality.

TRANSVERSELY CONTRACTED PELVIS.

A transversely contracted pelvis is a pelvis in which there is marked symmetrical transverse narrowing of the pelvis.

Varieties.—Two varieties of transversely contracted pelvis are met with:—

(1) The bilateral synostotic, or Robert's pelvis.
(2) The kyphotic pelvis.

The kyphotic pelvis partakes of the nature of both a transversely contracted pelvis and of a funnel-shaped pelvis. In consequence, it is allocated to different classes of contracted pelvis by different writers. Litzmann classifies it as a funnel shaped pelvis, but we prefer to follow Spiegelberg and to classify it as a transversely contracted pelvis.

We shall discuss Robert's pelvis and the kyphotic pelvis separately.

ROBERT'S PELVIS.—This pelvis was first described by Robert* in 1842, and is generally known by his name. It is the result of bilateral synostosis of the sacro-iliac joint, similar to that which occurs on one side in the oblique pelvis of Naegele.

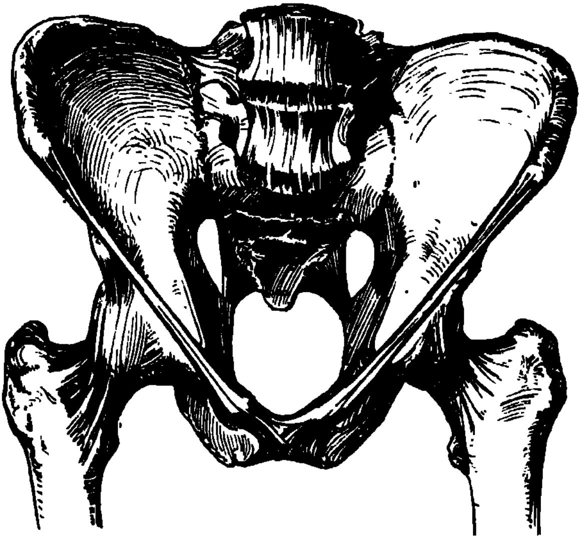

FIG. 321.—TRANSVERSE CONTRACTION OF THE PELVIS. ROBERT'S PELVIS.

The union between the ilium and sacrum takes place at an early period of life, and thus causes arrest in development of the lateral masses of the sacrum, so that this bone is very narrow at its upper part, and is, indeed, of almost the same width throughout. Its vertical curvature is lessened or absent, and its transverse curvature is replaced by a forward convexity, produced by the action of the body-weight when the bone is in a more or less plastic condition, and after ankylosis has taken place. The osseous union with the ilia prevents the normal outward leverage of the sacrum on these bones, and thus the os innominatum on each side pursues an almost straight course from behind forwards, and the ilio-pectineal lines, which are often unusually prominent, are almost parallel in their posterior part. The antero-posterior diameter is of normal length or else is slightly diminished, and the oblique diameters are rather shorter than normal; but the most marked change is the contraction of the transverse diameter, which may be reduced at the pelvic brim to less than three inches in length. This contraction, moreover, is present throughout the whole pelvic canal, and increases at the outlet in consequence of the great inversion of the tubera ischii. The inlet is triangular in shape, the narrow base being formed by the sacral promontory and the apex lying in front at the symphysis pubis. Often, the outlet is merely an antero-posterior slit between the ischia, so that the cavity of the pelvis from above downwards is wedge-shaped.

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* 'Beschreibung eines im höchsten Grade querverengten Bekens,' etc., Karlsruhe v. Freiburg, 1842.

In front, the descending rami of the pubes are almost vertical in direction, and meet above at a very acute angle. The bodies of the pubic bones look more outwards than forwards. The iliac fossæ are flat, more vertical than normal, and are directed forwards, and the curvature of the iliac crests is diminished.

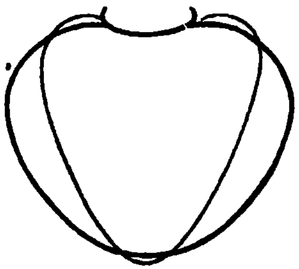

FIG. 322.—ROBERT'S PELVIS.

Outline of the brim. (Outline of normal pelvis in black, of contracted pelvis in red.)

The essential cause of this deformity is probably identical with that which leads to unilateral synostosis, such as is found in the pelvis of Naegele. Without doubt, in a majority of cases, the failure of development of the alæ of the sacrum is to be referred to a congenital anomaly, by which the ossific centres, from which these portions of the bone are normally formed, fail to appear, and the ankylosis then takes place secondarily. In other cases, the ankylosis may be primary, and occur as the result of some disease affecting the sacro-iliac joint, or else rapid ossification, and consequent ankylosis, may have occurred in the bones which were from the first united by cartilage, owing to the non-appearance of the joint cavity.

Other writers believe that in all cases the sacrum is primarily displaced forwards in early life from some unknown cause, possibly injury, and that synostosis then results, due to non-apposition of joint surfaces. This last theory is in some degree supported by the fact that the sacrum is always sunk deeply between the iliac bones, and that occasionally the displacement forwards is more marked on one side. The approximation of the posterior superior iliac spines behind the sacrum forms an important diagnostic addition to the results obtained by internal pelvimetry.

Synostosis of both sacro-iliac joints in adult life is not uncommon, and is especially frequent in Ireland, as a result of arthritis deformans. It does not give rise to any deformity, but might possibly retard labour by rendering the nutation of the sacrum impossible.

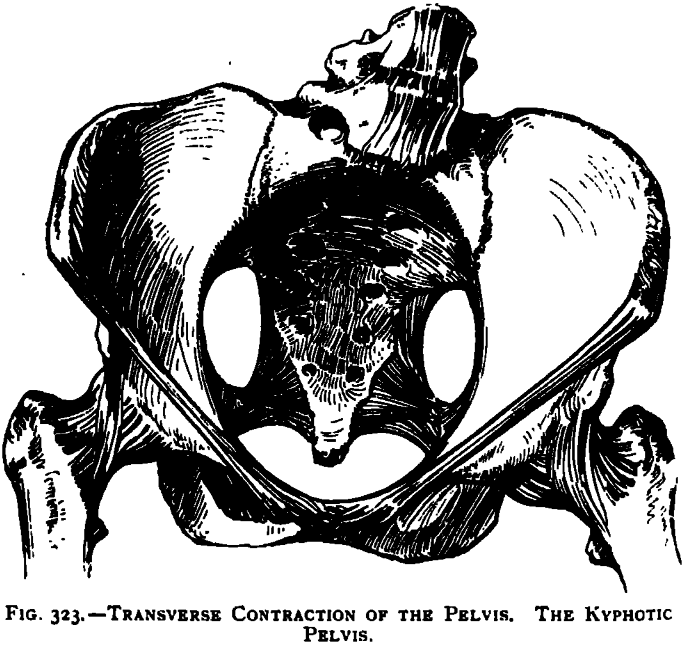

FIG. 323.—TRANSVERSE CONTRACTION OF THE PELVIS. THE KYPHOTIC PELVIS.

Frequency.—Robert's pelvis is one of the rarest forms of pelvic contraction met with. Only about eight cases of this deformity have been described.

Symptoms.—The effect of Robert's pelvis on the mechanism of labour is similar to that of any of the extreme degrees of contraction. The fœtus can never be expelled by the natural efforts, and in many cases it is most difficult to extract it even by craniotomy.

Diagnosis.—The external examination of the patient reveals marked shortening of the inter-spinous and inter-cristal distances, and of all the transverse measurements of the pelvis. Vaginal examination will at once make evident the shortness of the transverse diameters of the true pelvis, and the almost parallel course of the pubic rami.

Treatment.—If possible, Cæsarean section should be performed in all cases. If this course cannot be adopted, craniotomy must be performed.

Prognosis.—The prognosis in this deformity is bad. Of the eight cases mentioned by Spiegelberg, six were delivered by Cæsarean section and two by perforation. Both the latter died.

THE KYPHOTIC PELVIS.—The effect on the pelvis of posterior curvature of the vertebral column depends upon the position of the curvature. When it is situated in the lower lumbar or lumbo-sacral region, a form of transversely contracted pelvis is produced, the amount of deformity varying inversely with the height of the curvature above the pelvis. As a rule, in these cases a slight compensatory lordosis exists in the dorsal region. The most common cause of the kyphosis is tubercular caries of the vertebral bodies, and, in some cases, the base of the sacrum itself may be involved. Most of the pelvic changes are due to the abnormal direction in which the body-weight is transmitted to the sacrum —namely, from above downwards and backwards; but Freund asserts that some of the deviations from the normal adult type are due to the persistence of the fœtal or infantile form, and that secondary changes occur later as a result of the kyphosis.

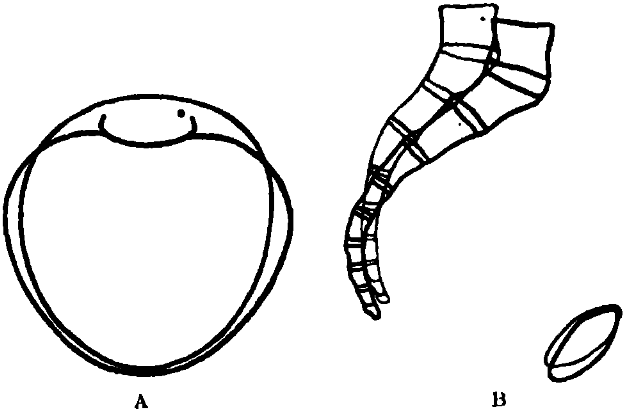

FIG. 324.—THE KYPHOTIC PELVIS.

A, Outline of brim ; B, sagittal section. (Outline of normal pelvis black, of contracted pelvis in red)

On examining such a pelvis, it is found that the posterior curvature has drawn the base of the sacrum backwards, causing it to rotate on its transverse axis, so that the apex is directed more forwards than usual, and the long axis of the bone is situated almost in the vertical plane. The centre of gravity of the body is also displaced backwards, and the body-weight is thus prevented from exerting its normal influence in driving the sacrum forwards and downwards into the pelvis. Its influence in driving it directly downwards is, however, increased, and thus the sacrum becomes sunk deeply between the iliac bones. At the same time, the obliquity of the pelvis is diminished in order that the equilibrium of the body may be maintained, and an increased strain is thrown upon the ilio-femoral ligaments, as is manifested by the prominence of the anterior inferior iliac spines. The failure of the sacrum to sink forwards lessens the strain upon the sacro-iliac ligaments, and in consequence diminishes their leverage action upon the ossa innominata, and leaves the inward thrust of the heads of the femora uncompensated. The result of this is that both innominate bones are less curved than normal, and that both the conjugate and oblique diameters of the brim are widened, while at the same time a moderate degree of transverse contraction is produced.

At the outlet, both conjugate and transverse diameters are contracted, the former owing to the forward movement of the lower end of the sacrum, and the latter in consequence of inversion of the tubera ischii. The pelvis therefore has a distinctly funnel shape.

Amongst other peculiarities of this type of pelvis, we may note that the sacrum is smaller transversely than normal, while its transverse concavity is increased. The pull upon it from behind and above increases its length and diminishes its vertical curvature. The curvature of the iliac crests is diminished, so that their anterior spines are widely separated. On the other hand, the narrowness of the sacrum causes the posterior superior iliac spines to become approximated. The pubis is narrow and somewhat pointed anteriorly, instead of being flat, and the sub-pubic angle is narrowed. When the lumbar kyphosis is unusually marked, the upper arc of the curve may overhang the pelvic inlet in such a manner as to almost completely roof it over.

In those cases in which kyphosis is situated high up in the dorsal region, little or no effect is produced on the pelvis, or else a compensatory lumbar lordosis may exist, and this, overhanging the pelvis, produces great antero-posterior contraction just above the brim, giving the pelvis something of the appearance found in spondylolisthesis. The pelvic obliquity is at the same time increased, and thus an additional obstacle to the passage of the child is introduced.

Frequency.—A kyphotic pelvis is of more common occurrence than is the variety we have just discussed. Klein * collected

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* 'Die Geburt beim Kyphotischen Becken,' *Archiv f. Gyn.*, 1896, l. 1-128.

85 cases amongst 511,360 patients, and he believed that its true frequency was greater than these figures show.

Symptoms.—In kyphotic pelvis, the fœtus usually lies with the back posterior, probably due in some cases to the absence of the lumbar curve of the spine, and in others to the pendulous abdomen (Champneys *) and the consequent absence of the usual adaptation between the concavity of the abdominal surface of the fœtus and the convexity of the lumbar spine. Internal rotation occurs earlier than is normal, in consequence of the action of the narrowed pelvic outlet, and posterior rotation of the occiput is common. Where the kyphosis is very low, and a sinking in of the bodies of the vertebræ has resulted from their destruction by caries, there is a consequent extreme shortening

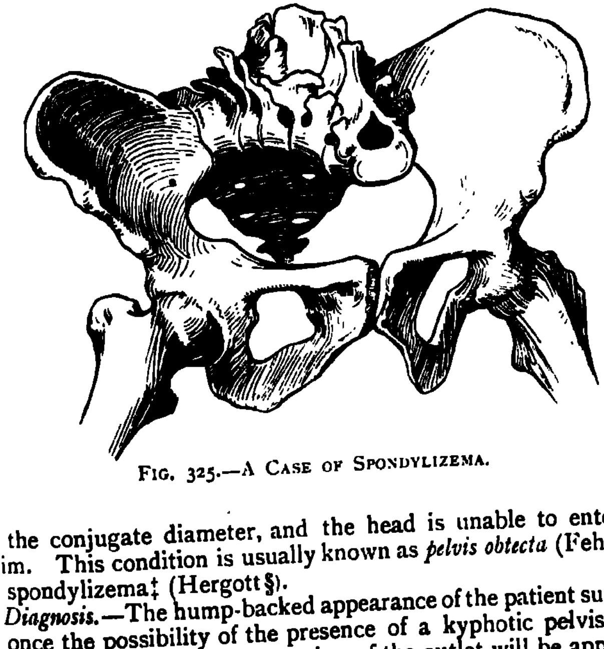

FIG. 325.—A CASE OF SPONDYLIZEMA.

of the conjugate diameter, and the head is unable to enter the brim. This condition is usually known as *pelvis obtecta* (Fehling†) or spondylizema‡ (Hergott§).

Diagnosis.—The hump-backed appearance of the patient suggests at once the possibility of the presence of a kyphotic pelvis. On vaginal examination the narrowing of the outlet will be apparent, and this can be confirmed by measurement. According to Spiegelberg, the distance between the anterior superior spines is increased, the symphysis is high and prominent, the promontory far back and difficult to reach, the distances between the ischial spines and the ischial tuberosities are both diminished, and the pubic arch is narrow.

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* 'Obstetrics of the Kyphotic Pelvis,' *Trans. Obstet. Soc. Lond.*, vol. xxv., p. 166.

† 'Pelvis Obtecta,' *Archiv f. Gyn.*, 1872, iv. 1-33.

‡ *Arch. de Tocologie*, fourth year, 1877, i. 65, and *Annal. Gynéc.*, vii., 1877.

§ σπόνδυλος, a vertebra; ἵζημα, a sinking.

Treatment.—If the contraction is not very great, the expulsion of the fœtus may be left to the natural efforts, and if these fail to effect delivery, an attempt may be made to extract the fœtus with the forceps. If this fails, craniotomy must be performed. Version is contra-indicated, as the extraction of the after-coming head would be rendered most difficult by the narrow outlet, and, if it could not be extracted, its perforation would be also difficult. In some cases, it may be advisable to induce premature labour, and, in extreme degrees of contraction, Cæsarean section must be performed.

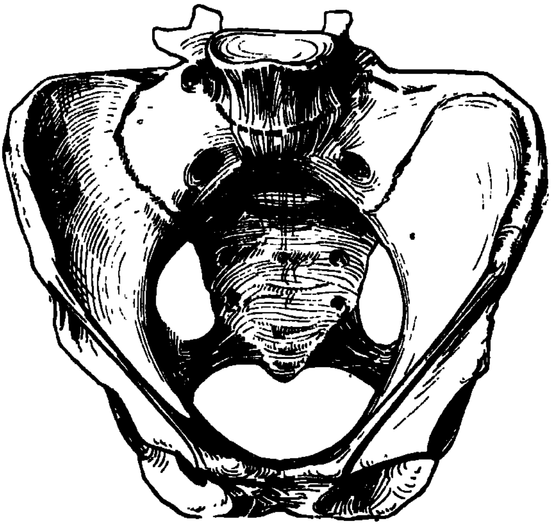

FIG. 326.—THE FUNNEL-SHAPED PELVIS.

Prognosis.—The prognosis of this form of contraction is serious for both mother and fœtus. Champneys* estimates the maternal mortality at 28·1 per cent., the fœtal mortality at 40·6 per cent.

FUNNEL-SHAPED PELVIS.

In addition to the kyphotic pelvis which has been just described, and which presents the appearance of an inverted wedge or funnel, there is another type of pelvis found independent of spinal curvature, to which the term 'funnel-shaped pelvis' is applied.

This form of pelvis is characterised by the fact that, while the various diameters of the brim are normal, or at most deviate but slightly from the normal, on tracing them down to the outlet they are found to undergo a gradual diminution in length. This diminution usually affects one diameter in a more marked degree than the other, and has thus led to a division of this variety of pelvis into transversely contracted funnel-shaped pelves, and antero-posteriorly contracted funnel-shaped pelves. Of these, the former is the more common, and is also the more important from an obstetrical point of view. It usually possesses male characteristics, and is, in fact, one of the varieties of the virile pelvis of some authors. The bones are rather massive and irregular, the pubic arch is narrow, and the depth of the pelvic cavity increased. The bodies of the ischia converge below, and the ischial spines project prominently inwards. The sacrum is narrow, is longer than normal, and its vertical curvature is lessened. Above, it is placed rather far back between the iliac bones; and, below, it projects forwards.

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* *Op. cit.*, p. 187.

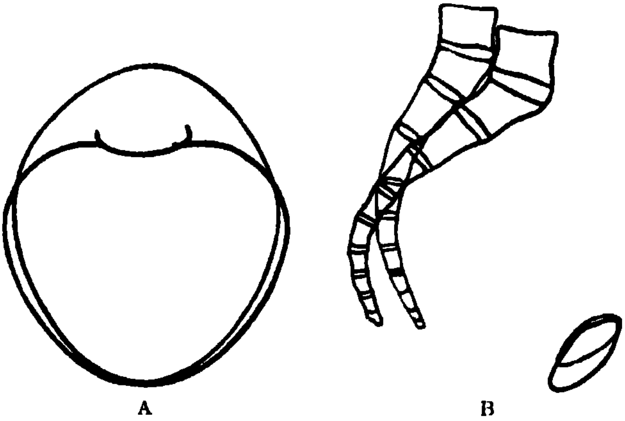

FIG. 327.—THE FUNNEL-SHAPED PELVIS.

A, Outline of brim; B, sagittal section. (Outline of normal pelvis in black, of contracted pelvis in red.)

The ætiology of the funnel-shaped pelvis is unknown. Its general appearance suggests that the pelvis has failed to develop into the adult form, and the position of the sacrum seems to show that at an early period of life the body-weight was transmitted in an abnormal direction, as occurs in the kyphotic pelvis. No cause for this mal-development or for the position of the sacrum has, however, been yet discovered.

Frequency.—The true funnel-shaped pelvis is of exceedingly rare occurrence. It is probably more common on the Continent than in these countries.

Symptoms.—As the diameters of the brim are unaffected in this class of deformity, there is nothing to prevent the head from entering the brim. The farther it descends into the pelvic cavity, however, the greater becomes the obstruction to its passage, and finally it is arrested before it reaches the pelvic floor. If labour is then allowed to continue, the head may become deeply marked by the pressure of the ischial spines. The other symptoms are similar to those met with in generally contracted pelvis.

Diagnosis.—The diagnosis of this class of pelvis is difficult Its existence will be seldom suspected in cases of slight deformity until the head is found to be arrested at the outlet. In cases of more marked deformity, vaginal examination may reveal the narrowness of the pubic arch, the slight divergence of the descending rami of the pubic bones, and the diminished distance between the ischial tuberosities (Spiegelberg). A definite diagnosis can be made by measuring the antero-posterior and transverse diameters of the pelvic outlet, as has been described.

Treatment.—If the contraction of the outlet is slight, it may be possible to extract the fœtus with the forceps. If, however, the contraction is considerable, nothing is to be gained by so doing, as the pressure of the pelvic bones on the head will bring about the death of the fœtus. In such cases, there is no alternative save to perforate the head. In subsequent labours, the induction of premature labour may be successful in medium degrees of contraction, but, in serious degrees, nothing but Cæsarean section will be of any avail.

Prognosis.—The prognosis is extremely bad for the child, as the nature and degree of the contraction is rarely recognised until it is too late to adopt any treatment other than craniotomy. It is also serious for the mother, as the condition may not be recognised and labour be allowed to continue too long.

Irregularly Compressed Pelvis.

The irregularly compressed or triradiate pelvis is one in which the weight of the body, transmitted through the spinal column and the femora and acting upon bones softened by disease, displaces the promontory and the acetabula inwards, and so produces gross distortion of the pelvis.

Varieties.—Two varieties of irregularly compressed pelvis are met with :—

(1) The osteo-malacic triradiate pelvis.
(2) The rachitic triradiate pelvis.

Frequency.—Both these forms of pelvis are exceedingly rare in these countries. The rachitic form demands for its production the presence of rickets of an advanced degree which, fortunately, is now seldom met with, while osteo-malacia is practically an unknown disease.

THE OSTEO-MALACIC TRIRADIATE PELVIS.—Osteo-malacia is a disease of the bones which is excessively rare in this country and in America, but which is found with considerable frequency in certain parts of Europe, especially in low-lying, damp situations. It very seldom occurs before adult life, and much more frequently attacks women than men. It is said to be as rare in nulliparous women as in men, and thus appears to be in some way definitely related to pregnancy. Indeed, it most often appears first during the period of gestation, and lasts till the puerperium, when, if the patient does not suckle her infant, slight recovery may set in till the onset of the next pregnancy, at the commencement of which there is again, as a rule, a marked increase in the disease.

Various theories have been advanced regarding the ætiology of osteo-malacia, some writers believing that it is bacterial in origin, and others that it is due to the presence of lactic acid in the bones; but, with the exception of the fact that it is known to occur under conditions which tend to lower the general vitality, such as insufficient proteid diet and living in damp, cold climates, nothing is known with any certainty. That something more than these is needed to produce the disease is proved by the fact that in Ireland a large percentage of the peasantry live under such conditions; frequently recurring pregnancy is the rule, and many of the women lactate during almost the entire period of their pregnancy, and yet the disease is practically unknown. In those places in Europe where it occurs, the increase that is noted in its severity during pregnancy is probably to be accounted for by the demands made on the maternal organism during that period to provide for the building up of the fœtal skeleton.*

The essential pathological factor met with in the disease is a chronic rarefying myelitis and osteitis, which cause a gradual absorption of the bony trabeculæ in the cancellous parts. The trabeculæ are at first replaced by a form of osteoid tissue devoid of calcium salts, but, later, they become infiltrated with a vascular granulation tissue chiefly composed of small round cells, and completely disappear, so that on cutting into the bone it appears to be entirely composed of a semi-solid and reddish pulp. The medullary canals of the long bones become enlarged, and the compact tissue is also in great part absorbed, the process of absorption commencing around the vessels in the Haversian canals and gradually extending. A thin layer of compact tissue, however, always remains persistent immediately under the periosteum. In advanced cases, the bones become quite flexible, and can readily be indented by slight pressure. Sometimes, the bones are universally attacked, but, in pregnant women, the disease is often most marked in the pelvis and the vertebral column. The changes which take place in the shape of the pelvis are the result of the pressure and counter-pressure of the body-weight, both in sitting and standing, acting upon abnormally softened bones, and to these forces must be added the influence of muscular contraction.

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* 'Text-book of Midwifery,' Spiegelberg, vol. ii., p. 113.

In the early stages, the patient usually continues to walk and stand, and therefore the first changes to appear are due to the pressure of the heads of the femora. The softened condition of the bones has rendered the outward leverage action of the ossa innominata totally ineffective, and therefore the tendency of the femora to drive the acetabular region upwards, backwards, and inwards is unopposed. As the bone gradually softens, the os innominatum yields at its weakest parts, which are, in front, the horizontal ramus of the pubis above and the ramus of the ischium below, and, behind, the bar of bone which bounds the great sciatic notch above. In consequence, the acetabular region

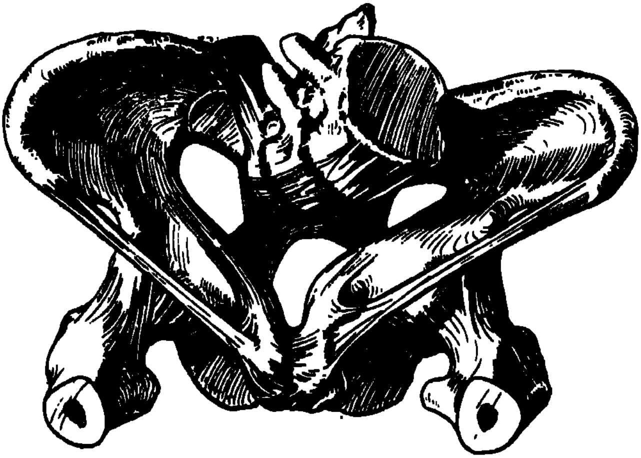

FIG. 328.—THE COMPRESSED OR TRIRADIATE PELVIS. THE OSTEOMALACIC PELVIS.

is slowly driven in towards the centre of the pelvis. Ultimately, the two acetabula may come so close as to almost touch one another, only a narrow crevice being left between them. This leads anteriorly into a slit-like recess, bounded in front by the symphysis and on each side by the bodies of the pubic bones, which have become so sharply bent at the symphysis as to be parallel with one another and almost to lie in the sagittal plane. They thus form a marked rostrum or beak at the front of the pelvis.

While these changes have been going on in the anterior portion of the pelvis, the pressure upon the base of the sacrum has gradually driven this bone downwards and forwards towards the centre of the pelvis, and at the same time has bent the bone upon itself, so that its vertical curvature is increased and the promontory forms a very marked projection at the inlet. This projection, together with the projection formed by the backs of the displaced acetabula, give to the inlet the characteristic triradiate appearance. The normal transverse concavity of the sacrum is replaced by a slight anterior convexity, since the bodies of the sacral vertebræ are more displaced than the alæ. The pull of the lateral masses upon the ilia, however, causes that portion of the ilium which lies posterior to the sciatic notch to bend forwards, and to form a sharp angular recess with the anterior portion of the bone, which, as we have already seen, is bent inwards and backwards by the femur.

In the early stages, the outlet of the pelvis is transversely contracted by the inward movement of the bodies of the ischia accompanying the acetabula. Later, the effects of sitting and lying greatly increase the contraction. The tubera ischii are inverted, and often come in contact with one another. The descending rami of the pubis descend almost vertically and in close contact, so that the sub-pubic angle is nearly obliterated. Pressure upon the apex of the sacrum and upon the coccyx causes them to bend upwards and forwards into the pelvis, and, in some cases, they may closely approximate the sacral promontory. In all cases, the contraction at the outlet is further advanced than that at the inlet. The obliquity of the inlet is diminished, principally as a result of the upward displacement of the anterior portion of the pelvic ring.

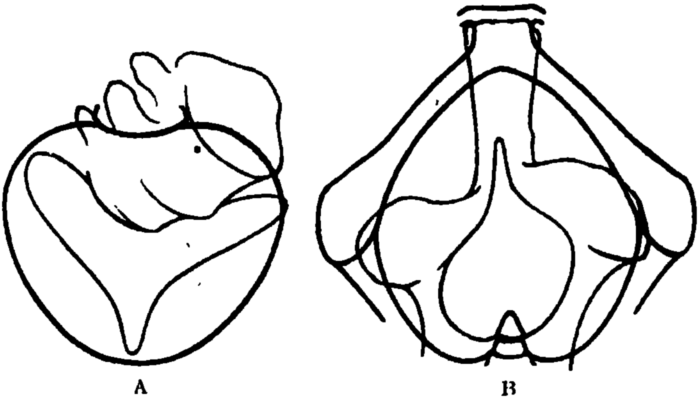

FIG. 329.—THE OSTEO-MALACIC PELVIS.

A, Outline of brim ; B, outline of outlet. (Outline of normal pelvis in black, of contracted pelvis in red.)

The iliac fossæ are distorted by the action of the muscles attached to them and by the drag of the posterior sacro-iliac ligaments. The crest becomes greatly curved, and the anterior superior spines are approximated. In all well-developed cases, the ilium is folded almost double upon itself, and the fossa divided by a deep groove into a posterior part which looks forwards, and an anterior part which looks backwards and inwards. Frequently, the deformity of the whole pelvis is somewhat asymmetrical, owing to the patient lying chiefly on one or other side, or else to the development of an early lateral curvature of the spinal column as a result of the disease, and the consequent unequal distribution of weight on the two sides.

Diagnosis.—The diagnosis can be readily made from the history and appearance of the patient and from the yielding nature of the pelvic bones. The last can be best determined by introducing the entire hand into the vagina while the patient is under an anæsthetic (Spiegelberg).

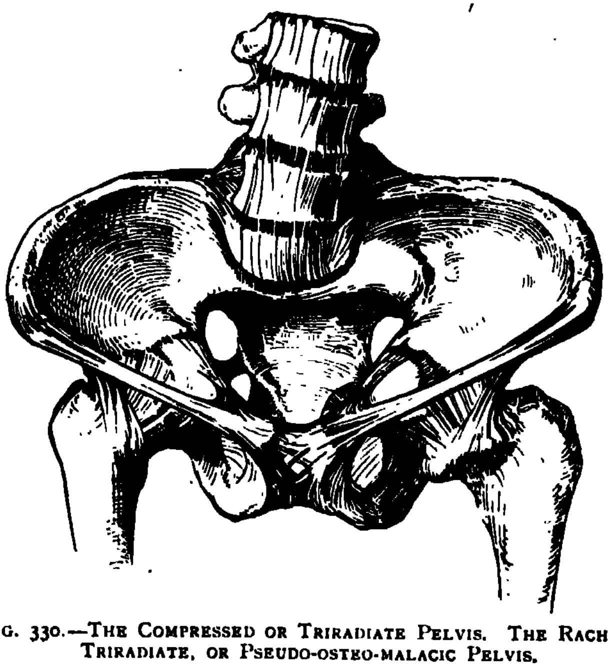

FIG. 330.—THE COMPRESSED OR TRIRADIATE PELVIS. THE RACHITIC TRIRADIATE, OR PSEUDO-OSTEO-MALACIC PELVIS.

Treatment.—Even an extreme degree of contraction of the pelvis in this condition is not the hopeless barrier to the passage of the fœtus that it would at first appear to be, as, in many cases, the bones are so soft as to allow an actual dilatation of the contracted canal during labour. In such cases, the fœtus may be forced through the pelvis by the natural efforts, or may be capable of being extracted by the forceps. In many other cases, however, even of a dilatable pelvis, Cæsarean section or symphysiotomy may be required. In thirty-two cases of dilatable pelvis collected by Hugenberger,* Cæsarean section was performed in seven cases and symphysiotomy in one case, other modes of artificial delivery were adopted in sixteen cases, and only eight ended spontaneously.

If the patient is seen during pregnancy and if the bones are yielding, premature labour should be induced. During labour, an attempt must be made to estimate the degree to which the bones will yield by introducing the hand into the vagina while the patient is under an anæsthetic. If there is reason to believe that the pelvic ring will dilate sufficiently to allow the head to pass, delivery should be left for as long as possible to the natural efforts, and then an attempt made to deliver by the forceps. If this fails, craniotomy will be necessary. If there is no reason to believe that the head can pass, Cæsarean section must be performed. Whether at the same time the ovaries should be removed, or a hysterectomy performed with a view to curing the disease, is still unsettled (Schaeffer†)

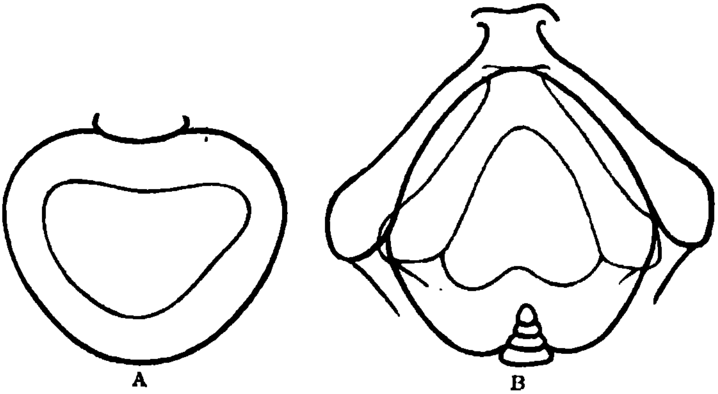

FIG. 331.—THE RACHITIC TRIRADIATE PELVIS.

A, Outline of brim; B, outline of outlet. (Outline of normal pelvis in black, of contracted pelvis in red.)

Prognosis.—The prognosis in a case of osteo-malacic pelvis is extremely bad for both mother and fœtus. In the thirty-two cases already referred to, and which were all cases of dilatable pelvis, the following results were found :—

In eight cases of Cæsarean section or symphysiotomy, the maternal mortality was 75 per cent., the fœtal mortality 50 per cent. In sixteen cases in which other methods of artificial delivery were adopted, the maternal mortality was 6·3 per cent.

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* *Petrsb. Med. Zeitsch.*, iii., 1872.

† 'Obstetric Diagnosis and Treatment,' p. 224.

and the fœtal 37·5 per cent. In eight cases which ended spontaneously, the maternal mortality was 12·5 per cent. and the fœtal mortality 37·5 per cent.

THE RACHITIC TRIRADIATE PELVIS.—The rachitic triradiate or pseudo-osteo-malacic pelvis very closely resembles the osteo-malacic pelvis, and is the result of very similar conditions. It is caused by a severe attack of rickets occurring at some period after the child has commenced to walk, and when the pressure of the femora is enabled to exert its full influence in producing distortion. The more advanced degrees of deformity are produced, as in true osteo-malacia, by pressure upon the outlet during the later stages of the disease, when confinement to bed becomes necessary. As recovery takes place, the bones rapidly harden and render permanent the triradiate appearance.

Symptoms.—The rachitic triradiate pelvis usually offers a complete obstruction to the expulsion of the fœtus, as the degree of the deformity of the pelvis is as great as in osteo-malacia, while, as the pelvic bones are rigid, they cannot be forced apart by the descending head, as in the latter condition.

Diagnosis.—The deformity can be distinguished in the adult from true osteo-malacia by the history and presence of other rickety signs, and by the fact that the bones, instead of being soft and pliable, are hard and irregular. The fossæ ilii are also smaller than normal; the groove on the iliac bone is never present, and the anterior superior iliac spines, instead of being approximated, are widely separated from one another, as in other varieties of rachitic deformity.

Treatment. — Cæsarean section will be necessary in almost every case, if the fœtus is to be saved. The only alternative is craniotomy.

THE SPONDYLOLISTHETIC PELVIS.

A spondylolisthetic pelvis (*σπόνδυλος*, a vertebra; *ὀλίσθησις*, a slipping) is one which is deformed by the detachment of the last lumbar vertebra from the sacrum, and the consequent gliding forwards of the lumbar vertebral column under the influence of the body-weight in such a manner as to overhang the pelvic brim (Kilian*). In this way, another form of ***pelvis obtecta*** is produced, and one which closely resembles that found in certain cases of low spinal kyphosis associated with caries of the bodies of the vertebræ. The condition with which we are now dealing, in which the vertebral column has slipped from the sacrum owing to defective inter-articular processes, is known as ***spondylolisthesis***, while the condition to which we have already referred, in which the vertebral column slips down owing to caries of the vertebral bodies, is known as ***spondylizema*** (*v.* Fig. 325).

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* 'De spondylolisthesi,' Bonn, 1853.

Frequency.—This is one of the rarest forms of contracted pelvis. At the time at which Spiegelberg wrote, only twelve examples of it were known to have occurred.

Characteristics.—The deformity in this class of pelvis is produced by a slipping downwards and forwards of the body of the fifth lumbar vertebra on to the upper part of the anterior aspect of the sacrum. The vertebral body in its descent, which always occurs gradually, carries the bodies of the remaining vertebræ along with it, so that a marked lumbar lordosis is produced and the height of the individual is considerably diminished. After a time, the fifth lumbar vertebra becomes fixed in its new position, with its lower aspect ankylosed to the anterior aspect of the first sacral vertebra. This variety of pelvis is very rarely met with in an advanced form, but minor degrees of displacement are comparatively common.

The predisposing causes of the downward displacement are not quite similar in all cases. The condition is not found in the fœtus, and the exciting cause after birth is the downward pressure of the body-weight. In order that this force may produce such an effect there must, however, be some alteration of the structure or attachments of the fifth lumbar vertebra. The latter is normally anchored securely in its place by the attachment of its neural arch to the laminæ of the first sacral vertebra by means of the posterior ligaments, and by the apposition of its inferior articular facets with the superior articular facets of the sacrum. On examining the body of this vertebra in a spondylolisthetic pelvis, no changes further than what can be referred to pressure atrophy can be detected in the majority of cases, and the same remark applies to the body of the first sacral vertebra. It is found, however, that while the body in its descent has carried its superior articular processes along with it, the inferior articular processes have remained fixed in their normal position, so that a condition of great antero-posterior elongation of the lower part of the spinal canal has been produced. It may be stated, in passing, that this elongation prevents pressure on the descending trunks of the sacral nerves. Owing to the above fact, it seems clear that the primary cause of the deformity must be some failure of bony union between the laminæ and inferior articular processes posteriorly, and the body of the vertebra together with the superior facets and a portion of the pedicles anteriorly. Such a want of union would allow the body to be displaced slowly downwards by weakening its posterior attachments, and, after it had come to rest, union could readily take place by an extension of the ossific centres of the body and neural arch.* In many cases, there is a history of a fall, or of some variety of injury, which has probably caused the separation by producing a fracture, and which may have still further predisposed to the displacement by partially dislocating the last lumbar vertebra forwards. In others, there is a history or signs of old inflammation. While, in a few, the separation must be referred solely to a congenital failure of development.

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* In this connection, it is interesting to note that some observers state that the neural arch of the fifth lumbar vertebra is always ossified by two centres on each side.

The effects upon the pelvis are to produce great shortening of the antero-posterior diameter at the brim, owing to the presence of a marked anterior lumbar curvature, which causes the lumbar vertebræ to overhang the pelvic inlet (*pelvis obtecta*). This curvature causes the centre of gravity of the body to be displaced forwards, and in compensation for this the obliquity of the pelvis is much diminished, so that the symphysis pubis assumes an almost vertical position and its upper border comes to lie opposite the third or second lumbar vertebra, according to the degree of displacement. The pressure backwards upon the upper part of the sacrum effects a rotation of this bone upon its transverse axis. The promontory moves backwards, causing a wide separation of the posterior extremities of the iliac bones, and the apex in consequence moves forwards and upwards into the pelvis. The strain thrown upon the sacro-sciatic ligaments by this rotation draws the tubera ischii inwards, and produces a narrowing of the transverse diameter at the outlet, which is in contrast with the rather wide transverse diameter of the brim.

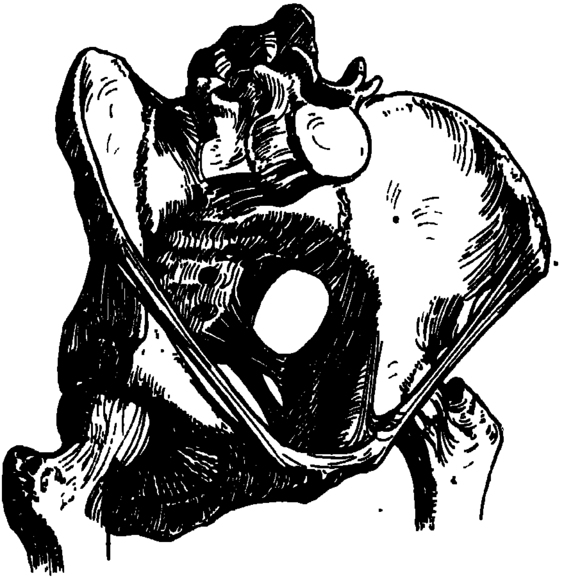

FIG. 332.—THE SPONDYLOLISTHETIC PELVIS.

Symptoms.—In almost all recorded cases, the degree of con traction present was so great that the passage of the fœtus was impossible.

Diagnosis.—The diagnosis of spondylolisthesis is chiefly based upon the great depression of the lumbar region, this being in striking contrast to the upper end of the sacrum, which projects well backwards (Spiegelberg). Further, the inclination of the pelvis is diminished, and the sacral and gluteal regions are broad, high, and steep. The posterior and anterior superior spines are prominent, and the distance between the latter is increased.

Treatment.—Cæsarean section is usually required if the fœtus is to be saved. If the contraction is not too great, the induction of premature labour may sometimes enable the fœtus to be delivered *per vaginam.*

PELVIS DEFORMED BY TUMOURS, FRACTURES, AND DISLOCATIONS.

The most common tumour, that arises from the pelvic walls, is an enchondroma. This grows most frequently from the upper part of the anterior aspect of the sacrum, or from some other part where cartilage is found—as, in the neighbourhood of the sacro-iliac joint, the acetabulum, or the back of the symphysis pubis. These tumours usually become ossified, and sometimes form large masses, which may almost completely fill the pelvic cavity. Exostoses may develop as a result of inflammation, or of ossification of the attachment of tendons and fasciæ, and are often found in the anterior part of the ilio-pectineal line, where a pointed projection inwards may be found on one or other side, and may attain a size large enough to cause laceration of the uterus. Such a projection is frequently the result of rickets, and is

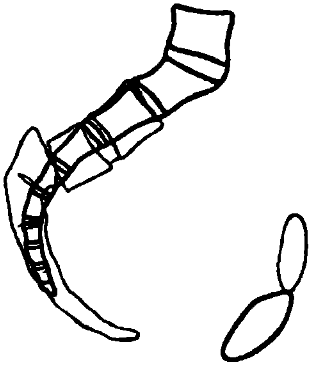

FIG. 333.—THE SPONDYLOLISTHETIC PELVIS.

Sagittal section. (Outline of normal pelvis in black, of contracted pelvis in red.)

especially dangerous when it occurs in association with rachitic contraction. In rickets also, the retro-pubic eminence is often markedly accentuated, and by introducing an obstacle to the descent of the head may cause a posterior parietal presentation. Obstruction may also be caused by osteo-sarcomata, fibromata, or carcinomata. A rare form of obstruction is that in which lymphatic growths, the result of lymphatic leukæmia, encroach upon the pelvic cavity from each side. As, however, leukæmia in its advanced stages usually precludes pregnancy, it is unlikely that such growths are of practical obstetrical importance.

Obstruction from fracture is comparatively rare, and may arise either from the primary displacement of the bone, or from an overgrowth of callus, which has failed to be absorbed. The deformity thus produced will obviously depend upon the situation and extent of the lesion. Most commonly it is unilateral, and consists of a depression of the anterior part of the pelvic ring. Fracture of the sacrum or coccyx, or dislocation of the coccyx forward, with subsequent ankylosis, may cause narrowing of the conjugate diameter of the outlet. A similar effect may be produced by osseous union of the various portions of the coccyx to one another, and of the first coccygeal vertebra to the sacrum. In these cases, fracture at the joint must occur during parturition, either by natural or artificial means, to allow the passage of the head.

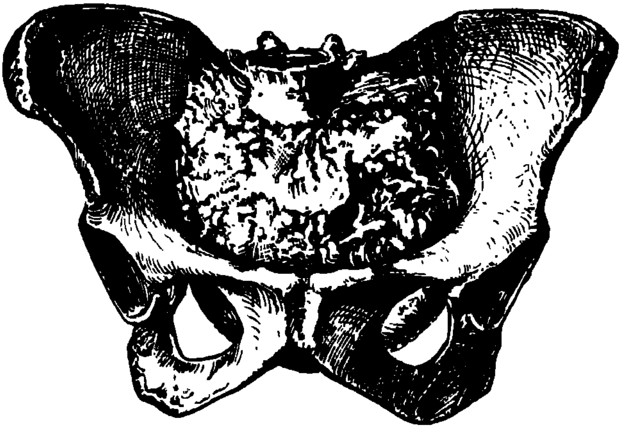

FIG. 334 -PELVIS NARROWED BY OSTEOID TUMOUR SPRINGING FROM THE SACRUM.

Symptoms.—The symptoms to which these conditions give rise depend on the exact nature of the pathological condition present, and upon the degree to which the obstruction encroaches upon the pelvic diameters. They consist, speaking generally, of high situation of the presenting part, the occurrence of malpresentations, and a varying degree of obstruction to the passage of the fœtus. Large tumours, which prevent the descent of the presenting part, are not so dangerous as small exostoses. The former condition is recognised at once, whilst the latter may easily escape detection, and may cause rupture of the uterus by attrition during delivery or the formation of fistulæ.

Diagnosis.—The diagnosis of large outgrowths is easily made by abdominal palpation or vaginal examination. Small exostoses can only be recognised by a careful vaginal examination, and even then it may be impossible to detect them. Whenever the presenting part is arrested in the brim or in the cavity, the

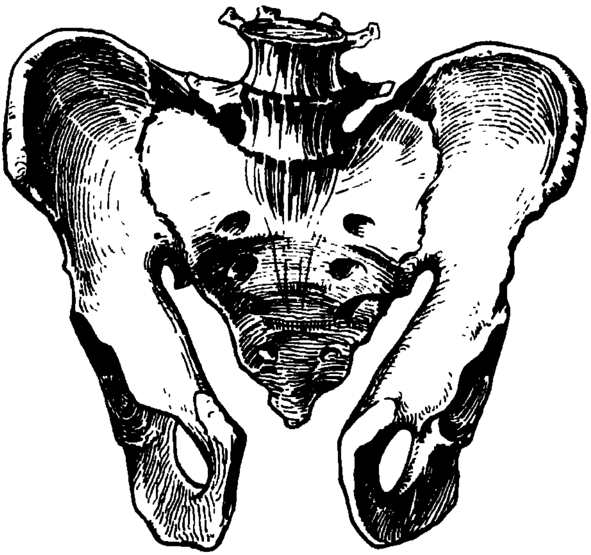

Fig. 335.—The Split Pelvis.

back of the symphysis, and the walls of the pelvis generally, should be examined carefully for the presence of such growths, and the condition of the sacro-coccygeal articulation be ascertained. The latter is done by grasping the coccyx between the index-finger in the vagina and the thumb externally in the cleft of the nates. Normally, a certain degree of mobility is present, but if there is ankylosis of the joint, the sacrum and the coccyx constitute a single bone, and all mobility is lost. If the coccyx has been previously dislocated, and has become ankylosed in a wrong position, it will form a small projection, sticking out in whatever direction it was previously displaced.

Treatment.—The treatment to be adopted depends upon the situation of the growth, fracture, or dislocation, and upon its effect upon the pelvic diameters. In the case of tumours of the soft structures of the pelvis, Cæsarean section is usually indicated, as it is inadvisable, in consequence of the danger of setting up necrotic changes, to subject them to the compression that would occur if a fœtus was dragged forcibly past them.

SPLIT PELVIS.

The split pelvis is almost invariably associated with ectopia vesicæ, and, since in most of these patients the generative organs are imperfectly developed, the condition is very seldom met with in parturient women. Even when patients the subject of this malformation do become pregnant, little or no difficulty is experienced during labour, in consequence of the absence of any resistance in front. The pubic bones are not in contact anteriorly, but are separated by an interval of from seven to eleven centimetres (Winckel), which is filled in either by a fibrous band stretching between the opposed surfaces, or else by the soft tissues of the perinæum. The sacrum is longer than normal, and is narrow, and it is displaced forwards into the pelvis, lying deeply between the iliac bones, to which it is attached in some cases by an osseous union. The conjugate diameter is diminished in length, and the transverse, though often actually diminished, is relatively increased by the outward displacement of the innominate bones. On the whole, the pelvis closely resembles the flattened rachitic form.

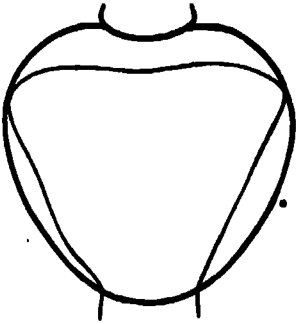

FIG. 336.—THE SPLIT PELVIS.

Outline of brim. (Outline of normal pelvis in black, of contracted pelvis in red.)

CHAPTER V

ANOMALIES OF THE GENITAL ORGANS

Tumours of the Genital Organs—Of the Uterus, Fibro-myoma, Cancer—Of the Ovaries—Of the Vagina and Vulva. Stenosis and Atresia of the Genital Passages—Of the Cervix—Of the Vagina and Vulva.

When discussing, in a former chapter,* the effect of anomalies of the genital organs upon pregnancy, we in some instances also referred to their effect upon labour, because it was found difficult to disassociate the two. Accordingly, we need not here again refer to the effect of displacements or congenital malformations of the uterus upon labour, and so we shall only deal with such other anomalies as may affect the course of labour. These fall into two groups:—

I. Tumours of the genital organs.

II. Stenosis and atresia of the genital passages.

TUMOURS OF THE GENITAL PASSAGES.

Tumours of the genital passages affecting the course of labour may spring from the uterus, the ovaries, the vagina and the vulva.

Tumours of the Uterus.

The principal tumours, which may be met with in the uterus during labour, are fibro-myomata and cancer. These must be discussed separately.

Fibro-myoma of the Uterus.—Fibro-myomata are perhaps the most common form of tumour met with as a complication of pregnancy or labour. As has been already pointed out, they rarely affect the course of pregnancy, though sometimes they may cause abortion. They are, however, not uncommon causes of dystocia.

Effect on Labour.—Myomata may affect the course of labour in one of three ways:—By interfering with the contractions of the uterus either prior to, during, or subsequent to, the expulsion of the fœtus; by offering an obstacle to the descent of the fœtus; or by causing a malpresentation.

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* *Vide* Part VI., Chap. IV., p. 552.

It is extremely difficult, and sometimes quite impossible, to forecast their exact effect in any given case. In attempting to arrive at an opinion, three factors must be taken into consideration:—The size of the myoma; its position as regards the uterus; and its position as regards the pelvic cavity.

The size of the myoma is an all-important factor. These tumours may vary in size from that of a hazel-nut to that of a pumpkin, and whereas tiny myomata will give rise to little or no trouble, no matter where they are situated, and medium-sized myomata may not give rise to trouble unless their position is particularly unfavourable, large myomata will as a rule affect the course of labour prejudicially and irrespective of their position. Very small myomata, if numerous and interstitial, may interfere with the contraction and retraction of the uterine muscle, and so cause delayed labour and post-partum hæmorrhage, particularly if they are situated in the neighbourhood of the placental site. Medium-sized and large myomata may bring about malpresentations or offer a bar to the descent of the presenting part.

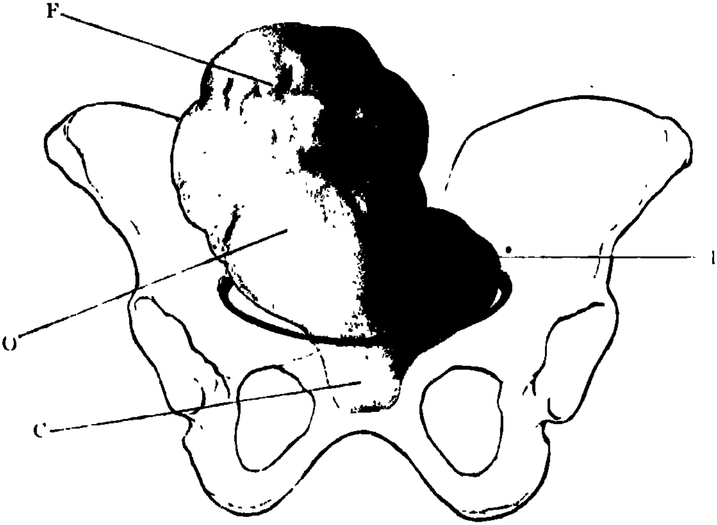

Fig. 337.—A Myomatous Uterus which is Three Months Pregnant.

F, Myoma of fundus; L, myoma of lower segment; O, site of ovum; C, cervix. (Bumm.)

The exact situation of the myoma in the uterus is also a matter of considerable importance. Fundal myomata may give rise to weakened and irregular contractions, and so cause delayed labour and post-partum hæmorrhage. They are particularly dangerous if situated in the neighbourhood of the placental site. Myomata situated in front of the presenting part may offer an obstacle to the descent of the part, but such a result is by no means the rule. It not infrequently happens that a myoma, which at the commencement of labour occupied a position that would seem to effectually bar the descent of the fœtus, is drawn up, as labour

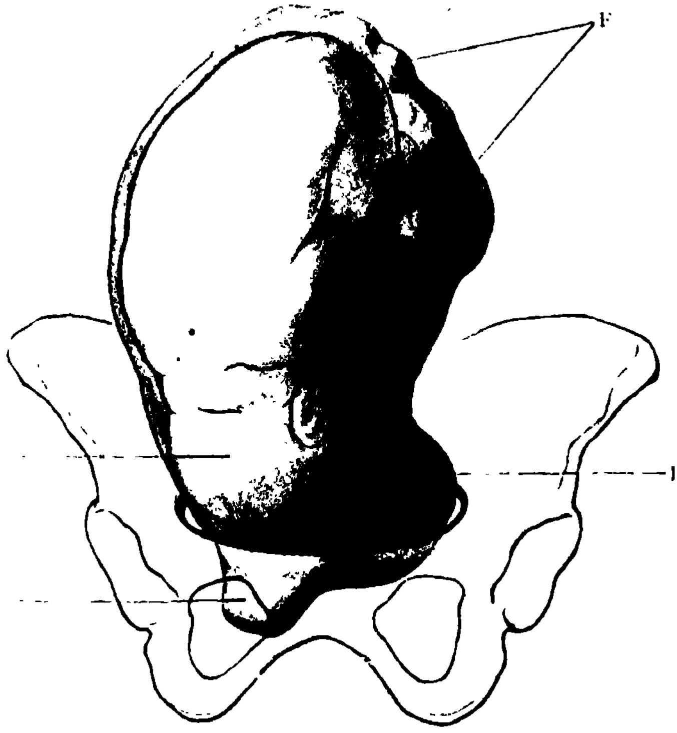

Fig. 338.—The Myoma shown in Fig. 337 at Full Term.

F, Myoma at the fundus; L, myoma in lower segment blocking the pelvic brim; H, head of fœtus; C, cervix. (Bumm)

advances, by the retraction of the upper uterine segment or the cervix (*v.* Figs. 337-339). Pedunculated myomata springing from the uterine body or the cervix and which protrude into the vagina, will not be drawn up in this manner, and if of sufficient size will almost certainly prevent or retard the descent of the presenting part.

A myoma springing from the lower uterine segment or cervix may be freely movable, or may be impacted in the pelvic cavity.

If it is movable, it is frequently possible to push it upwards above the presenting part, or it may slip above it as labour proceeds, as has been just described. If it is impacted, it is usually impossible to push it upwards, but here again, unless the impaction is very firm, the retraction of the uterus may draw it upwards.

Diagnosis.—The existence of myomata that are situated above the pelvic brim will be most easily ascertained by abdominal palpation. They may be found as single or multiple nodules of varying size, or as one or two larger masses. When they are subserous, there is usually no difficulty in recognising their presence. When they are interstitial or submucous, they are often mistaken for fœtal parts—small myomata counterfeiting a fœtal elbow, knee, or heel, and large myomata a head or breech. In such cases, their presence is frequently not detected until the third stage of labour. A diagnosis is made by noting the fact that, while a fœtal part can be moved about inside the uterus, a myoma in the uterine wall moves with the uterus and possesses no separate range of motion. Myomata projecting into the uterine cavity impart a sense of increased resistance when the uterine wall is depressed by the fingers, and render it difficult or impossible to palpate the subjacent fœtal parts. Pedunculated myomata, attached to the surface of the uterus, are felt as globular masses possessing a range of motion in proportion to the length of their pedicle. They simulate ovarian tumours, from which it is difficult to distinguish them by abdominal palpation alone.

The existence of myomata in the pelvic cavity may be suspected when we find the presenting part pushed upwards out of the pelvic brim. Their presence is confirmed by a vaginal examination, and, at the same time, their exact relation to the uterus is ascertained. In some cases, it may be necessary to administer an anæsthetic in order to make an exact diagnosis. If there still is any doubt, the hand should be passed into the vagina, and the lower segment of the uterus carefully examined with one or more fingers in the uterine cavity, if the uterine orifice is sufficiently dilated to allow the finger to be introduced. In the case of a pedunculated tumour in Douglas' pouch, the differential diagnosis between a myoma and a solid ovarian tumour may be difficult. However, if the tumour cannot be pushed upwards out of the pelvis, it must be removed whether it is uterine or ovarian, and its nature will be then discovered.

Treatment.—The treatment of myomata during labour is a difficult matter to describe shortly in a text-book. At present, authorities are by no means agreed as to the best treatment to adopt, and moreover each case presents so many features that are peculiar to it, that the question of treatment is a most complex one. The various procedures which may be adopted are as follows:—

(1) The Myoma may be pushed out of the Pelvis.—This procedure should always be attempted, before resorting to more radical measures, when a myoma is found lying below the presenting part. If the myoma is not impacted in the pelvis, it can frequently be pushed upwards, but the administration of an anæsthetic is usually necessary. If it does not slip up at the first attempt, we should wait for a little—an hour or two—according to the stage of labour, and then try again. If we succeed in

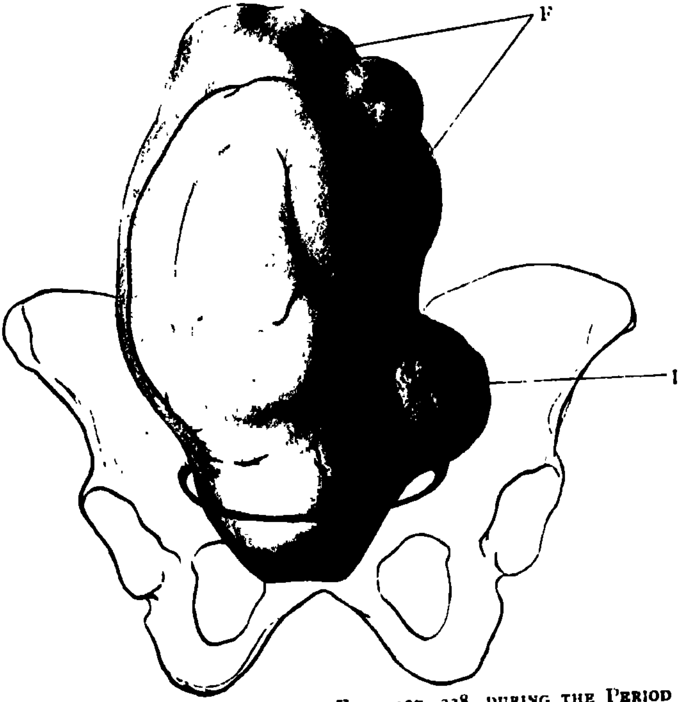

FIG. 339.—THE MYOMA SHOWN IN FIGS. 337, 338, DURING THE PERIOD OF DILATATION.

F, Myoma of fundus; L, myoma of lower segment which has been drawn upwards at the pelvic brim during the dilatation of the cervix. (Bumm.)

pushing the tumour above the presenting part, and the latter omes down into the pelvis, the expulsion of the fœtus may then be left to the natural efforts, or the forceps may be applied.

(2) Expectant Treatment may be adopted.—By expectant treatment we mean that the delivery of the fœtus is left to the natural efforts until the condition of the patient calls for the termination of labour. Such a course can usually be adopted in cases in which the myoma does not interfere with the descent

of the presenting part, and also in those cases in which we have reason to believe that the myoma will be drawn upwards out of the pelvis as labour proceeds. If, however, the myoma remains below the presenting part, a more radical treatment must be adopted.

(3) The Myoma may be removed.—This is only necessary when the myoma lies below the presenting part, and is either pedunculated or situated in or quite close to the cervix. If the myoma is pedunculated and protruding into the vagina, it should always be removed. In such a case, it can be twisted away, or excised after ligation of the pedicle. If it is sessile and within reach, it may be enucleated, unless it is drawn upwards as labour proceeds.

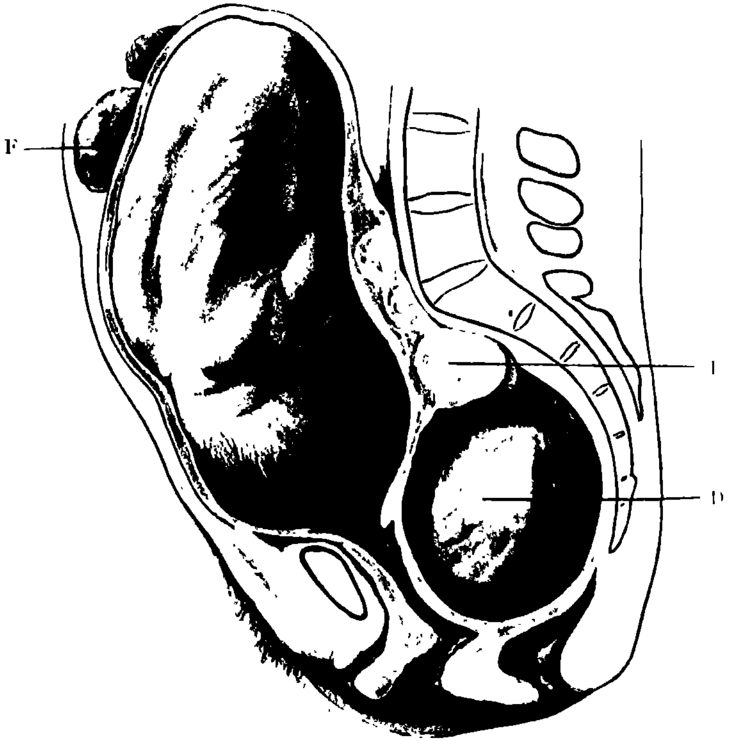

FIG. 340.—A LARGE SUBSEROUS MYOMA IMPACTED IN DOUGLAS' POUCH, AND BLOCKING THE GENITAL CANAL.

F, Subserous myoma of fundus; I, interstitial myoma; D, subserous myoma in Douglas' pouch. (Bumm.)

(4) Cæsarean Section may be performed, followed or not by

Hysterectomy.—This procedure is only necessary when the myoma is so situated, and of such a size, as to prevent the escent of the presenting part, and when it can neither be removed or pushed upwards out of the way. If Cæsarean section has to e performed, the uterus should be removed at the same time, nless the condition of the patient or the circumstances under which the operation is performed render it inadvisable to do so. n some cases, as when a pedunculated subserous myoma is mpacted in the pelvis, it may be possible to draw the tumour upwards and to remove it either without performing Cæsarean ection or after it has been performed, and thus to save the uterus.

The choice of the mode of treatment to be adopted depends almost entirely upon the nature of the case and the previous experience of the obstetrician. In some cases, the procedure to be adopted is obvious. The size and situation of the myoma may be such as to preclude all possibility of delivery through the vagina, or, on the other hand, they may offer no bar to the natural delivery of the fœtus. In the former case, Cæsarean section, with or without a following hysterectomy, and in the latter case the expectant treatment, are clearly indicated. In other cases, the correct procedure is not so obvious, and in such the most rational course to adopt is to be ready to perform hysterectomy if necessary, but to wait as long as possible to see whether the natural efforts, aided by upward pressure from the vagina, may not succeed in removing the obstruction. We must not, however, wait too long, as by so doing we are running the risk of being compelled to perform Cæsarean section under unfavourable circumstances. It may be stated, as a general rule, that myomata situated on the anterior or antero-lateral wall of the uterus are likely to be drawn upwards during labour, while myomata on the posterior or postero-lateral wall are unlikely to be drawn up, as they tend to become more and more firmly impacted in the hollow of the sacrum as the presenting part descends. The mere fact that the fœtus can be dragged past a myoma in the pelvis is not always a reason for so delivering it, as the risk of a myoma becoming necrotic and sloughing after it has been much compressed is very great, and the prognosis in such a case is distinctly worse than if Cæsarean section had been performed at the proper time.

Prognosis.—The presence of a myoma is a serious complication of labour. As we have seen, it may offer an obstruction to delivery and so cause rupture of the uterus; it may so affect the contractions that uterine inertia results, and retained placenta and post-partum hæmorrhage occur; it may be so crushed during delivery that it subsequently sloughs, and septic or saprophytic nfection follows. However, with the advances in our knowledge of aseptic technique and in the practice of operative obstetrics and gynæcology, the mortality met with in labours complicated by myomata is by no means so high as it was in former years.

According to the results collected by two observers[*] prior to 1890, out of 372 cases of myomata complicating labour, there were 196 maternal deaths, a percentage mortality of about 47; while in 264 of these cases, there was a fœtal mortality of 174, or 66 per cent. If these figures are compared with those collected by Thumin,[†] of cases in which Cæsarean section or some form of hysterectomy was performed, and which were operated upon between 1885 and 1900, we can see how great is the improvement. This writer gives the statistics of 208 cases with 22 maternal deaths, a percentage mortality of 10·5. All these were cases in which a major operation was performed, whereas the former statistics included many cases in which delivery was effected by the natural passages.

CANCER OF THE UTERUS.—Cancer of the uterus as met with during labour almost invariably affects the cervix. It is a rare condition, as, if it is far advanced, it usually prevents the occurrence of conception.

Effect upon Labour.—The principal effects of cancer of the cervix upon labour is to interfere with the progress of dilatation of the cervix and to give rise to cervical laceration and hæmorrhage, since the normal elastic and muscular fibres of the cervix are replaced by the non-elastic and friable malignant growth. Septic infection of the uterine cavity may also occur, in cases where parts of the cervix are sloughing.

Diagnosis.—The diagnosis of malignant disease of the cervix is readily made by means of a vaginal examination, or by direct inspection of the cervix through a speculum. The characteristics of cervical cancer are so well known that they need not be here referred to. If the entire cervix is affected, there will be little or no dilatation, but, if the disease is in an early stage, dilatation may proceed as usual.

Treatment.—When discussing the treatment of cancer of the uterus during pregnancy, we stated that immediate hysterectomy should be performed in all cases in which there was any hope of the complete removal of the growth, and that only those cases should be allowed to go to full term in which it was hopeless to endeavour to save the mother's life. In labour, the same remark as regards immediate operation holds true. Malignant disease of the uterus grows and disseminates itself far more rapidly during pregnancy or the puerperium than it does at other times, due in all probability to the increased size and number of the blood and lymph vessels. The treatment to adopt depends upon the extent of the disease and the circumstances under which we see the patient. One of three courses may be adopted:—

(1) The fœtus may be delivered through the vagina either

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[*] Nauss and Süsserott, *Jahresb. u. d. Fortsch. a. d. Gebiete der Geburtsh.*, etc., vol. v., p. 175.

[†] *Archiv für Gynäk.*, vol. lxiv., 1901, No. 3, pp. 457-525.

without or after preliminary perforation and embryotomy, and hysterectomy performed as soon subsequently as possible. This procedure can be adopted when the disease is not so far advanced as to prevent the necessary dilatation of the cervix. It is not, however, always the most suitable course, as the risk of subsequent septic infection from the cervix, a risk which is increased by the crushing the tissues undergo, is very considerable. It may, however, be necessary, if the condition of the patient or her surroundings prevent us from undertaking an immediate hysterectomy. If it is adopted, the uterus should be removed at the earliest possible date.

(2) The fœtus may be delivered as before, and an immediate vaginal hysterectomy performed. If the patient is seen under favourable circumstances, this is a wise procedure to adopt, as it offers the best prospect of avoiding infection of either the peritoneal cavity or the genital tract. The necessary dilatation of the cervix may be obtained by introducing hydrostatic dilators, or by deep incision of the cervix as recommended by Dührssen. The latter procedure is, however, open to the objection that it may favour the dissemination of the growth, and is perhaps better avoided.

(3) The fœtus may be delivered by Cæsarean section, followed, or not, by the removal of the uterus by the abdominal or vaginal route. Delivery by Cæsarean section is the only procedure which can be adopted in cases in which the disease is far advanced. If there is a prospect of being able to remove the entire growth, the delivery of the fœtus should be followed by an abdominal or vaginal hysterectomy. Abdominal hysterectomy is the easier operation on account of the large size of the uterus. Whichever operation is adopted, as much as possible of the diseased tissue should be first destroyed with the cautery *per vaginam*, in order to minimise the risk of peritoneal infection. If there is no prospect of the complete removal of the growth, there is no object in performing hysterectomy, as it will not give any relief. In such cases, temporary benefit will be obtained by the destruction of as much of the growth as possible by the cautery and the application of a strong solution of chloride of zinc.

Prognosis.—The prognosis of cancer of the cervix, occurring during pregnancy or the puerperium, is worse than is the prognosis of the same condition at other times. Hense* has collected the results of cases, occurring during pregnancy or the puerperium, in which radical operations were performed, and which were under observation for at least five years, or until death occurred, and has compared them with the results in cases operated on after the menopause. Out of 122 cases in which radical operations were performed during pregnancy or the puerperium, 41 were watched for the necessary time. Of these, 31 patients died of a recurrence of the growth, and 10 patients, or 24 per cent., remained well after five years had elapsed. These results contrast markedly with the results, collected by the same writer, of radical operations performed upon patients who were past the menopause. In 73 cases in which a sufficient history was obtained, there were 36 recurrences, and 37, or more than 50 per cent., permanent cures.

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* *Zeitsch. für Geburts und Gynäk.*, Bd. xlvi., No. 1, 1901.

TUMOURS OF THE OVARIES.

Ovarian tumours are occasionally met with as complications labour. They may be situated either in the abdominal cavity to one or other side of the uterus, or, if of smaller size, may lie in Douglas' pouch. Ovarian tumours situated in the abdomen do not tend to cause any serious difficulties during labour, unless they are of very large size, when they may press the uterus out of the axis of the pelvic brim, or may interfere with the contractions of the voluntary muscles, and so delay labour. Such tumours are, however, usually diagnosed before the onset of labour, and should in all cases be removed as soon as they are recognised. Ovarian tumours, which have prolapsed into the pelvis, are much more serious, as they prevent the descent of the fœtal head. It is with them that we are here chiefly concerned.

Frequency.—The presence of a pelvic ovarian tumour complicating labour is of rare occurrence. According to Haultain, it is said to occur once in 4,000 cases. McKerron,[†] in an exhaustive paper on the subject, was able to collect 183 cases, and to these he subsequently added a further series of 80 cases.[‡]

Effect on Labour.—The effect on labour of the presence of an ovarian tumour in the pelvis depends on the size of the tumour and on its nature—*i.e.*, whether it is cystic or solid. A very small solid tumour or a slightly larger cystic one may get pushed into the hollow of the sacrum, and so may neither offer any obstacle to the birth of the fœtus, nor may itself be injured during the latter process. This, however, must be a very uncommon occurrence, and, as a rule, an ovarian tumour will offer a partial or complete obstacle to the descent of the fœtus, and, if the latter is forced past it, may be severely crushed and ruptured. In the former event, the obstruction to the passage of the fœtus may result in the rupture of the uterus, while, in the latter, necrotic and suppurative changes may take place in the tumour during the puerperium, and these in turn may give rise to a general or local septic infection. A third, and much rarer termination, is also possible, in which the fœtus in its descent drives the tumour downwards, and forces it through the floor of Douglas' pouch

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[*] 'Expulsion of Dermoid Ovarian Cyst *per Vaginam* during Labour,' *Journal of Obstetrics and Gynæcology*, April, 1902, p. 384.

[†] *Trans. Obstet. Soc. Lond.* for 1897, p. 334.

[‡] 'Pregnancy with Ovarian Tumour,' by R. G. McKerron, M.B. 1903, Rebman.

and the posterior vaginal wall, or in a few cases into the rectum. To this occurrence, the term 'natural ovariotomy' was applied by Playfair.

Diagnosis.—The diagnosis of the presence of an ovarian tumour in the pelvis cannot in all cases be made prior to opening the abdomen. If a cystic tumour is found in Douglas' pouch, it is almost certainly of ovarian origin, and it may be sometimes possible to make the diagnosis certain by determining the relations of the tumour to the uterus and pelvis. The diagnosis of a solid tumour is more difficult, and the latter can seldom be distinguished from a myoma prior to its removal. This, however, is of no practical importance, as in each case the treatment is similar.

Treatment.—A case in which a pelvic ovarian tumour complicates labour may be treated in one of the following ways:—

(1) Delivery may be left entirely to the natural efforts.

(2) The tumour may be pushed upwards into the abdomen, and delivery then effected artificially or left to the natural efforts.

(3) Delivery may be effected artificially, without reduction or reposition of the tumour.

(4) The tumour, if cystic, may be punctured or incised, and delivery then effected artificially or left to the natural efforts.

(5) Delivery by Cæsarean section, followed by ovariotomy.

(6) Ovariotomy by the abdominal or vaginal route, followed by natural or artificial delivery.

Before discussing these methods, it may be well to see what have been their respective results in the past, as gathered from the statistics collected by McKerron,* first in his communication to the London Obstetrical Society, and secondly in his monograph on this subject:—

MODE OF DELIVERY.	NO. OF CASES.		DEATHS.		PERCENTAGE MORTALITY.	
	1st Series.	2nd Series.	1st Series.	2nd Series.	1st Series.	2nd Series.
By natural efforts	35	5	12	0	34	0
Reposition	41	21	7	2	17	9·5
Artificial delivery without reduction or reposition	49	19	22	4	45	21
Puncture or incision	43	13	8	1	18	7·7
Cæsarean section	10	12	8	1	80	8·3
Ventral ovariotomy	2	6	0	0	0	0
Vaginal ovariotomy	3	4	0	0	0	0

As the percentage mortality with the different modes of treatment differs considerably in the two series, we have thought it well to group together the cases from both series which occurred subsequent to 1890. The number and result of these cases is shown in the following table:—

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* *Op. cit.*

Mode of Delivery.	No. of Cases.	Deaths.	Percentage Mortality
By natural efforts	2	0	0
Reposition	20	2	10
Artificial delivery without reduction or reposition	18	6	33·3
Puncture or incision	17	0	0
Cæsarean section	14	1	7·1
Ventral ovariotomy	8	0	0
Vaginal ovariotomy	7	0	0
Total	86	9	10·4

From these tables, we can obtain information which may guide us in the selection of the most suitable treatment. Delivery by the natural efforts alone gave disastrous results at the time it was adopted. Since 1890, it has been practically abandoned, though two successful cases are recorded. Artificial delivery —*i.e.*, delivery by forceps, version or perforation—both in past and recent times has given equally bad results, and must be condemned absolutely. The other modes of treatment may all be regarded as satisfactory, but the statistics of immediate ovariotomy are considerably the best. It is hardly necessary to emphasise the fact that in all cases in which Cæsarean section is performed it should be accompanied by ovariotomy. Accordingly, we may take into account four modes of treatment:—Reposition; reduction in size, followed by natural or artificial delivery; Cæsarean section, followed by ovariotomy; and abdominal or vaginal ovariotomy, followed by natural or artificial delivery.

(1) Reposition.—The reposition of the tumour—that is, the pushing it upwards out of the pelvic cavity—can be performed under the following conditions:—The presenting part must not be fixed; the tumour must not be impacted or adherent; and the pedicle must be of sufficient length to allow the necessary change in position of the tumour. The relatively high rate of mortality, which has attended this procedure, is due chiefly to the subsequent occurrence of septic peritonitis from infection of the contents of the tumour. At first sight, reposition seems a simple and safe procedure, but the danger of lacerating the tumour or twisting its pedicle during reposition is considerable. It is not the treatment of election, and should be kept for those cases in which circumstances forbid the performance of a major operation. It is carried out by placing the patient in the knee-chest position, and then pushing the tumour upwards with the fingers in the

vagina or rectum, as the case may be, very much as is done in the reposition of an incarcerated retroverted uterus. The administration of an anæsthetic will usually be required. The tumour must be removed as soon as possible after delivery.

(2) Reduction in Size.—A cystic tumour may be reduced in size by puncture with a trochar and canula through the posterior vaginal wall, or its contents may be drained off by making an incision into it. The cause of the high mortality in the past was apparently septic infection, and, with improved modern technique, seventeen cases have been recorded in recent years without a death. This procedure may be adopted when a major operation cannot be performed and attempts at reposition have failed, and should be followed by an ovariotomy at the earliest possible date. It may also be adopted when the tumour cannot be removed, by either vaginal or abdominal cœliotomy, until the uterus has been emptied—that is, in cases in which the alterna-

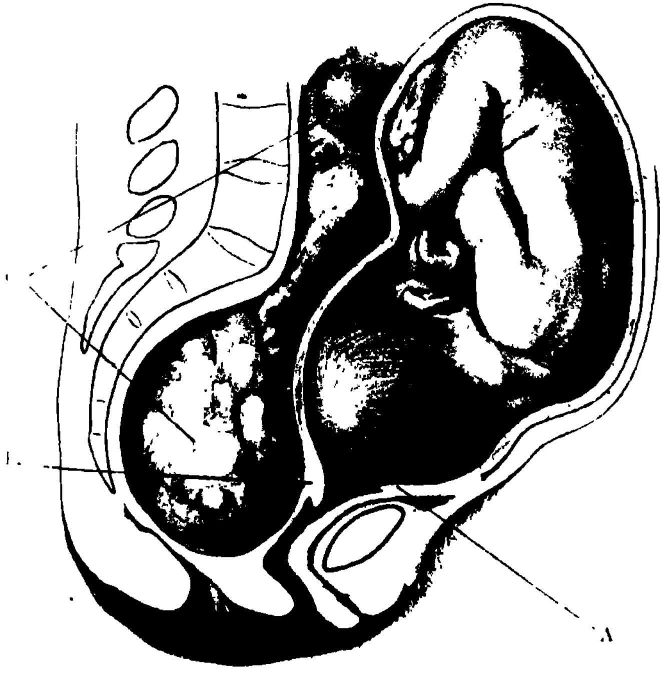

Fig. 341.—A Large Ovarian Cyst complicating Pregnancy. Part of the Cyst is Impacted in Douglas' Pouch, and prevents the Descent of the Head.

C, Ovarian cyst; P, posterior lip of cervix, A, anterior lip. (Bumm.)

tive would be to perform Cæsarean section and then ovariotomy. In such cases, by puncturing or incising the tumour, extracting the fœtus, and then performing ovariotomy by whatever route is thought best, the necessity for Cæsarean section is avoided. When immediate ovariotomy cannot be performed, and the tumour has been incised, its cavity should be kept plugged with iodoform gauze, which is changed daily.

(3) Cæsarean Section.—Cæsarean section is only required in cases of solid tumours which cannot be removed until the uterus has been emptied. It should be always accompanied by ovariotomy.

(4) Ventral or Vaginal Ovariotomy.—Ventral or vaginal ovariotomy constitutes the most suitable procedure in all cases in which the condition of the patient and her surroundings do not forbid the performance of a major operation. The vaginal route is preferable, and is the only possible route in cases in which the presenting part is fixed. If part of the tumour extends into the abdominal cavity, the ventral route must be adopted.

Prognosis.—The figures which we have given in the second table above show a death-rate in recent years of less than 10·5 per cent. for all cases of ovarian intra-pelvic tumours. These results show an enormous improvement over the earlier results, as, prior to 1876, the maternal mortality was 34·7 per cent.

TUMOURS OF VAGINA AND VULVA.

New growths met with in the vagina may spring from the vaginal walls or from the uterus. In the latter case, they are usually polypi which have been expelled from the uterus, or which are growing from the cervix. Their treatment has been already referred to when discussing myomata. New growths having their origin in the vagina are extremely rare, and need not be taken into account. Cancer of the vulva, however, is occasionally met with, though it is also a very rare condition. Tumours other than new growths occasionally occur. The most common are œdematous swellings of the labia, vaginal and vulvar cysts, and hæmatomata.

Effect on Labour.—Malignant disease of the vagina or vulva affects labour in a similar manner to malignant disease of the cervix—that is to say, it tends to cause narrowing and obliteration of the passage. The other tumours act similarly, but as they can be removed they are not important.

Treatment.—Malignant disease of the vagina or vulva is, as a rule, both an actual and a theoretical bar to delivery through the natural passages. If the disease is at all advanced, it wil prevent the necessary dilatation of the canal, while in any case—as in cervical cancer—the bruising which it undergoes during the extraction of the fœtus favours dissemination, and, at the same time, by causing necrosis, increases the danger of septic infection

Accordingly, in almost every case in which the conditions of the patient and her surroundings are favourable to the performance of a major operation, Cæsarean section constitutes the best line of treatment. If circumstances forbid its performance, then delivery by the natural passages may be carried out, provided that the growth is not so extensive as to render the passage of even a mutilated fœtus impossible. When the growth is situated at the vulva, additional space for the passage of the fœtus may be obtained by deep incisions of the perinæum. Such a procedure is, however, distinctly inadvisable, as it favours dissemination and septic infection, and should only be adopted in cases in which the performance of Cæsarean section is impossible.

The treatment of the other forms of tumour is more simple. Œdematous swellings of the vulva rarely cause any trouble. If they are so large as to obstruct delivery, they must be punctured, and the fluid allowed to drain away. Puncture should, however, be avoided whenever possible, as the anæmic condition of the parts retards the healing of any wounds of the skin. Punctured wounds are, however, preferable to the lacerated wounds caused by rupture, and therefore ought always to be made if there appears to be any danger of rupture.

Vaginal cysts are sometimes met with, but vulvar cysts connected with Bartholin's gland or its duct are more common. If they are of such a size as to offer an obstruction to delivery, they must be punctured with all aseptic precautions. Subsequently, if they fill again, they must be removed.

The treatment of hæmatomata will be referred to later.*

STENOSIS AND ATRESIA OF THE GENITAL PASSAGES

STENOSIS AND ATRESIA OF THE CERVIX.—Stenosis (στένος, narrow) is the term applied to the narrowing of the lumen of a canal, while atresia means an imperforate condition (ἀ, negative; τετραίνω, I perforate). All cases of atresia, as met with in pregnancy and labour, may be regarded as only advanced cases of stenosis, inasmuch as it is obvious that the atresia cannot have existed prior to conception. Accordingly, the two conditions may be discussed together.

Etiology.—The causes of stenosis or atresia are to be found in any condition that has destroyed or altered the normal tissues of the cervix. These causes may be grouped together according as they are due to the effects of age, to inflammatory changes, to traumata, and to new growths. In elderly primiparæ, there is sometimes an increased rigidity of the fibres round the os externum or of the entire vaginal portion, due probably to the diminution in the number of elastic fibres consequent on commencing senile atrophy (Dührssen). Stenosis, the result of inflammatory changes, must be of very rare occurrence, as it is doubtful whether the common simple inflammations of the cervix ever give rise to it. It may, however, occur in cases of extensive ulceration, the result of an acute septic or gonorrhœal process, or of syphilis. Stenosis, the result of trauma, is, on the other hand, perhaps the commonest form met with. It may be the result of extensive lacerations of the cervix; of badly performed or too extensive operations, as trachelorrhaphy or amputation of the cervix; of extensive sloughing of the cervix, the result of a prolonged labour, or of the too extensive use of caustics; or of the friction and irritation to which the cervix is subjected in cases of long-standing prolapse of that part. The effect of new growths on the cervix has been already dealt with, and we have seen that malignant disease of that part always gives rise to stenosis, and when it has become extensive even to atresia.

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* *Vide* Part VII., Chap. IX., p. 860.

Effect on Labour.—The effect of atresia or stenosis on labour is to produce a condition closely resembling that which has been described under the head of spasmodic contraction of the cervix, save that the resulting stricture is organic instead of functional. In atresia, the cervix in many cases will not dilate until a new opening has been made. In stenosis, dilatation is delayed or never occurs, according to the degree to which the tissues are altered. Serious consequences may result from this. First, and most commonly, the contractions are not strong enough to overcome the resistance; they die away, and a condition of uterine inertia results. Secondly, the contractions may force the fœtus through the narrow cervix and cause extensive lacerations, leading to the occurrence of traumatic post-partum hæmorrhage. Thirdly, the condition of the cervix may prevent the passage of the fœtus, and, the contractions continuing, rupture of the uterus may occur.

Diagnosis.—The diagnosis of stenosis of the cervix is readily made by means of a vaginal examination, after labour has been in progress for a little time. The cervix is found to be but little if at all dilated, and in part or altogether preserves the shape it possessed prior to the onset of labour. The cause of the stenosis may be found on careful examination or inspection. In atresia of the os externum, the taking up of the cervix may proceed as usual, but, on examination, the smooth and thinned-out tissues of the cervix are found to completely cover the presenting part, and no aperture can be felt. A small dimple, or thickening, corresponding to the former site of the os can usually be detected. If the stenosis or atresia affects more than the region of the os externum, the affected portion of the cervix will be felt projecting from the lower pole of the uterus as a mushroom-like prominence of a thickness varying with the extent of cervix affected.

Treatment.—The treatment of atresia consists in re-constituting the obliterated portion of the cervical canal. If the os externum alone is obliterated, due to simple agglutination of the edges, slight pressure with the tip of the finger or with the point of a sound may suffice to re-open it. If this is not sufficient, an incision must be made with a scalpel. Once the canal has been re-opened, rapid dilatation will as a rule occur. In cases of stenosis due to causes other than malignant disease, dilatation may be hastened by hot vaginal douches, and hot hip-baths. If, however, the alterations in the tissues are extensive, the cervix must be dilated or incised. The manner in which these procedures are carried out will be described later. As a general rule, it will be found that if the undilated portion of cervix is thin, and consists only of the tissues in the neighbourhood of the external os, incision is preferable, while if there is a considerable thickness of undilated cervix, dilatation is preferable. The treatment of stenosis due to cancer of the cervix has been already described.

Stenosis of the Vagina and Vulva.—Stenosis of the vagina or vulva may occur as a result of congenital deformities, previous extensive ulceration, or malignant disease. In some cases, it may be so marked that the canal is barely patent.

Effect on Labour.—The effect on labour is identical with that of stenosis of the cervix, *i.e.*, obstructed delivery and possibly extensive lacerations of the stenosed part during the passage of the fœtus.

Diagnosis.—The diagnosis is readily made by a vaginal examination, but care must be taken to prevent mistaking the ring of stenosed tissue for the edges of the uterine orifice. If the possibility of confusing the two conditions is remembered, the mistake will not be made.

Treatment.—Stenosis due to the presence of cicatricial bands or congenital septa may be relieved by the division of such bands or septa. Slight degrees of cicatricial stenosis may be relaxed by hot douches, glycerine plugs, or by the use of a hydrostatic dilator. In more marked degrees, it may be necessary to make several incisions in the constricting tissues. These incisions are made peripherally round the stenosed portion of the vagina, and must be sufficiently deep to divide the cicatrices. The fœtus is then extracted with the forceps, if the natural efforts are not sufficient to expel it. If the incisions subsequently bleed, they must be sutured, or the uterus and vagina must be tamponned with iodoform gauze. If the stenosis is so great that sufficient room for the passage of the fœtus cannot be obtained by incision, the fœtus—if dead—may be perforated and extracted, or, if the contraction is too great even for this to be successful, Cæsarean section must be performed. If the stenosis is situated at tne orifice of the vagina, sufficient space may be obtained by the performance of episiotomy or incision of the perinæum.

CHAPTER VI

MULTIPLE PREGNANCY

Multiple Pregnancy—Frequency—Ætiology—Superfœtation—Superfecundation—Presentation—Sex and Development—Diagnosis—Course of Labour—Management—Prognosis. Interlocking of the Infants—Diagnosis—Treatment.

MULTIPLE PREGNANCY

By multiple pregnancy, is meant the simultaneous presence of more than one fœtus in the uterus. The greatest number of children born at a birth, which has been authentically reported, is six.

Frequency.—Twin pregnancies are of comparatively frequent occurrence, but the exact proportion of cases in which they occur varies considerably in different countries. Thus Churchill found amongst 285,219 labours occurring in the British Isles, 3,718 cases of twins, or a proportion of 1 in 76·5; while, according to French statistics as collected by Bertillon, the proportion in France is 1 in 101. The statistics of the Rotunda Hospital show a proportion of 1 in 76·62.

Triplets are of very much rarer occurrence. In Churchill's list of British cases, 43 instances of triplets are recorded, a proportion of 1 in 6,000. According to the statistics of Dubois, based on 484,550 labours occurring in England, France, and Germany, the proportion of triplets was 1 in 6,209. The statistics of the Rotunda Hospital show a proportion of 1 in 5,000, but this proportion is considerably in excess of the true proportion in Ireland, as the tendency of such patients is to seek the aid of a maternity hospital, owing to the size of the uterus or some concomitant pathological condition.

The proportion of cases in which quadruplets occur is 1 in 371,126, according to Veit. Quintlets are of too rare occurrence to be able to give even an approximate proportion.* So far as we know, at least two authentic cases of sexlets have been recorded. The first case was recorded by Vassali in 1888. There were four boys and two girls, who altogether weighed 1,730 grammes (3 lb. 13 oz.), the largest weighing 305 grammes (10 oz. 12 drams), the smallest 240 grammes (8 oz. 7·5 drams).

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* *Op. cit.*, p. 480.

The second case was recorded by Kerr and Cookman,* and occurred at Accra, on the Gold Coast, in a negress. Five of the children were boys, the sixth a girl. Between the children, there were four placentæ. The girl and one boy had a placenta each, while the remaining four children were attached by pairs to two placentæ. All the children were born alive. One lived two days, four lived three days, and one lived four days. It is stated that the patient at her first confinement gave birth to four children, at her second confinement to three children, at her third to three children, and at her fourth—that to which we refer—to six children, a total of sixteen children at four confinements.

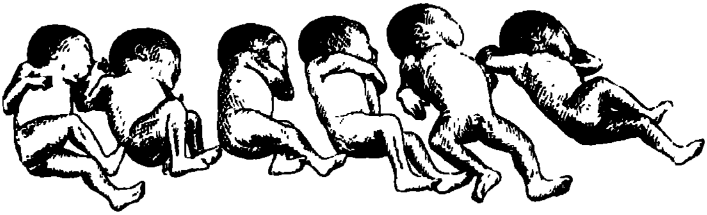

Fig. 342.—A Case of Sexlets (Kerr and Cookman, from a photograph.)

Etiology.—Twin pregnancy may result in one of three ways:—

(1) Two distinct ova may be fertilised. These ova may come from separate Graafian follicles, which may both come from one ovary or one from each ovary, or they may come from the same Graafian follicle. Twins derived in such a manner will be entirely separate from one another and have separate placentæ, separate amnions, and separate chorions (*v.* Fig. 343).

(2) One ovum may contain two yolk sacs, each with its own nucleus. Twins derived in such a manner will have a common placenta and chorion, and separate amnions (*v.* Fig. 344).

(3) A single germinal area may divide into two embryos. In such a case there will be a common placenta, chorion, and amniotic sac (*v.* Fig. 345).

It must be remembered that in the case of twins derived in the first manner, the placentæ may lie so close to one another in the uterus that their edges coalesce, and a common placenta apparently result. The fact that there are two chorions will, however, render the nature of the case clear. Also, in the case of twins derived in the second manner, the double fold of amnion which intervenes between the two sacs may become absorbed, and the twins may thus lie in a common amniotic sac. This is said to occur in about twelve per cent. of such cases (Galabin), and renders it practically impossible to distinguish them from those arising in the third manner. Triplets usually arise as a result of twins developing from one ovum and a single embryo from another, and quadruplets are probably due to two sets of twins, each developed from a single ovum. In one of the most recently recorded cases of quintlets—that by Sato[*] of Japan, the first and the second fœtus were apparently developed from one ovum, the third and the fourth from another, and the fifth from a third.

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* *Medical Press and Circular*, May 27, 1903, p. 538.

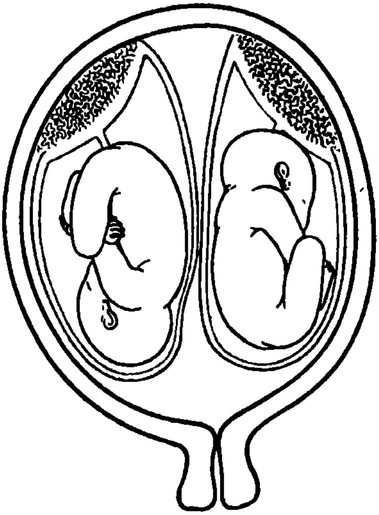

FIG. 343.—DIAGRAM OF BI-OVULAR TWINS.

Note the separate placentæ, chorions, and amnions.

The actual causes which favour the occurrence of twins are but little understood.[1] Race, as we have already shown, has an important effect,[2] as also has heredity, particularly when transmitted through the mother. This can be understood, as there is no reason why a hereditary tendency should not be transmitted to the production of ova which contain two nuclei, or of two ova at the same time. It is, however, very difficult to explain the action of heredity transmitted through the father, inasmuch as in all conceptions sufficient spermatozoa gain access to the genital tract to fertilise an indefinite number of ova. Still, apparent proof of such influence is forthcoming, even if the seemingly fabulous cases recorded by Sue and by Velpeau are refused credence.* 3 The tendency to multiple pregnancy is apparently greatest in the first pregnancy, and least in the second, and again progressively increases with each subsequent pregnancy.† 4 Lastly, twins are of more common occurrence when the mother is between twenty-one and twenty-eight.

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[*] *Sei-I-Kwai Medical Journal*, 1902.

The question of the possibility of superfecundation and of superfœtation is closely associated with the mode in which multiple pregnancy occurs. By superfecundation, is meant the fertilisation at a second coitus of an ovum belonging to the same period of ovulation as the first ovum, while by superfœtation is meant the fertilisation of a second ovum belonging to a subsequent period of ovulation.

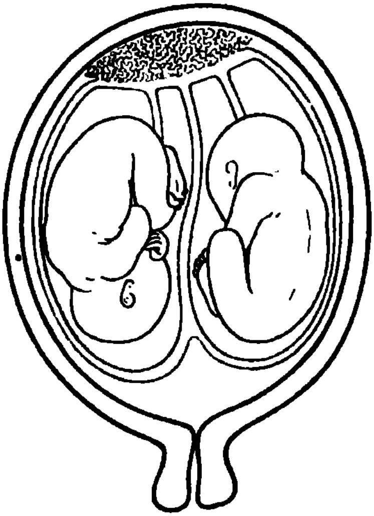

FIG. 344.—DIAGRAM OF UNI-OVULAR TWINS, DERIVED FROM OVUM WITH A DOUBLE NUCLEUS.

Note the single placenta and chorion, and the two amnions.

The possibility of superfecundation has been demonstrated by cases in which a woman has had intercourse about the same time with a black and a white man, and has been subsequently delivered of one pure-blooded twin and one mulatto. It is of frequent occurrence amongst animals. The possibility of superfœtation occurring in a normally developed uterus is, to say the least, extremely doubtful. In the first place, in order that it should occur, ovulation must continue during pregnancy, and

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[*] *Vide* Parvin's 'Science and Art of Midwifery,' p. 173.

[†] *Vide* Matthew Duncan's work 'On Fecundity, Fertility, and Sterility.'

this, though possible, is in all probability extremely rare. Secondly, there must be the means of conjunction of the ovum and the spermatozoon. This is not impossible up to the time of the fusion of the decidua vera and reflexa in the fourth month, but it is improbable, as the hypertrophy of the uterine and tubal mucous membrane almost certainly leads to a functional blockage of the lumen of the tube, while the plug of mucus which forms in the cervix at an early period of pregnancy closes the cervical canal. Superfœtation may occur under certain conditions. When the first ovum develops in a Fallopian tube, it is possible that a second may subsequently be fertilised and develop in the uterus; and, when the uterus is double, an ovum may be fertilised at one side at one period, and at the other side at any subsequent period, provided ovulation occurs. Cases of superfœtation will usually be found to be due to the latter condition, if the patient is carefully examined. Cases in which the difference in the size of two twins suggests the possibility of superfœtation, but in which the uterus is single, are usually the result of interference on the part of one twin with the placental circulation of the other in the case of a common placenta, or to some pathological condition of one twin which prevents its development.

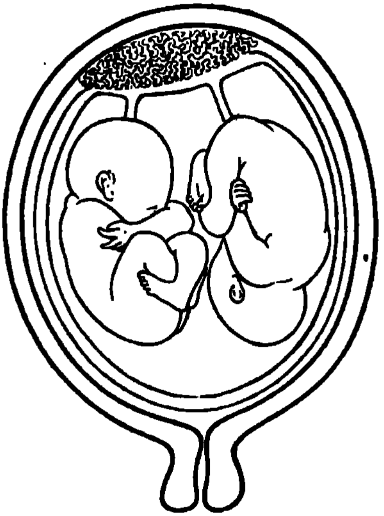

FIG. 345.—DIAGRAM OF UNI-OVULAR TWINS, DERIVED FROM SINGLE GERMINAL AREA.

Note the single placenta, chorion, and amnion.

4. *Presentations.*—As is to be expected, the relative frequency of malpresentations is very much more common in twin than in

single pregnancies, on account of the loss of the adaptation which normally exists between the shape of the fœtus and that of the uterus. The combined statistics of Depaul, Tarnier, and Pinard[*] show the relative frequency of the different presentations which occurred in 465 cases of twins:—

Both vertex	187	Face and vertex	2
Vertex and breech	117	Shoulder and vertex	2
Breech and vertex	74	Shoulder and breech	2
Both breech	48	Breech and face	1
Vertex and shoulder	16	Face and breech	1
Breech and shoulder	6	Forehead and vertex	1
Vertex and face	5	Unknown	3

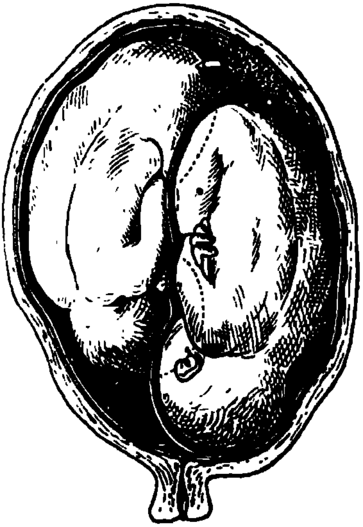

FIG. 346.—TWINS PRESENTING BY THE VERTEX.

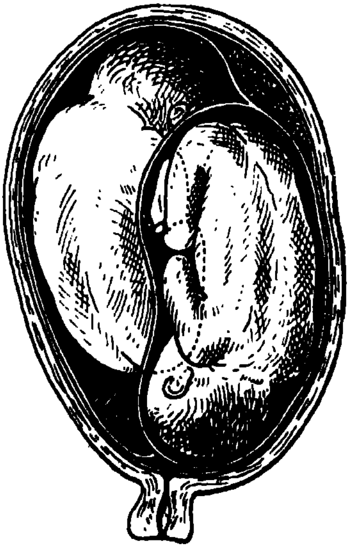

FIG. 347.—TWINS PRESENTING BY VERTEX AND BREECH.

From these figures it appears that in ten cases out of 466 the lie of the fœtus was transverse or oblique—*i.e.*, a percentage of 2·14. This is a high percentage, but not nearly so high as that given by Spiegelberg, who states that in 10 per cent. of cases a transverse presentation occurs. The statistics of Guy's Hospital are practically the same as the French statistics which we have quoted, *i.e.*, 2·3 per cent. for transverse lies.

Sex and Development.—In the case of twins derived from the same ovum, the sex is probably always the same; in the case of twins derived from different ova, the sex may be the same or may vary. Including all cases of twin birth, the following proportion was observed at the Rotunda Hospital, amongst 261 cases:—

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[*] Ribemont-Dessaignes, 'Précis d'Obstétrique,' 3rd edition, p. 623.

Two males	87 times.
Two females	90 "
Male and female	84 "

The weight of individual twins is often below the normal—a fact probably due to their usual prematurity, and to the mother being unable to supply as large a proportion of nutriment to each twin as she would have done to a single child. The average weight of the two children taken together is about nine and a half pounds.

7 *Diagnosis.*—The diagnosis of twin pregnancy can be made by abdominal palpation and by auscultation.

Abdominal Palpation.—The first point that is noticed by abdominal palpation—if the patient is at or near full term—is the unusual size of the uterus,2 and it may also be possible to determine that the walls are more tense and resisting than in a single pregnancy. 3 Then, on palpating the fœtal parts, we find that they do not follow one another in their usual sequence. If, for instance, we find a breech at the fundus, instead of being able to trace the fœtal outline along the back to the cephalic pole, we may find another large part—*i.e.*, a head or a breech—lying somewhere about the level of the umbilicus, or in one or other iliac fossa; or we may find an undue number of limbs in the neighbourhood of the umbilicus. We can diagnose the existence of twins by palpating two heads, two breeches, or two backs, more than two large parts, or more than four limbs. We cannot,

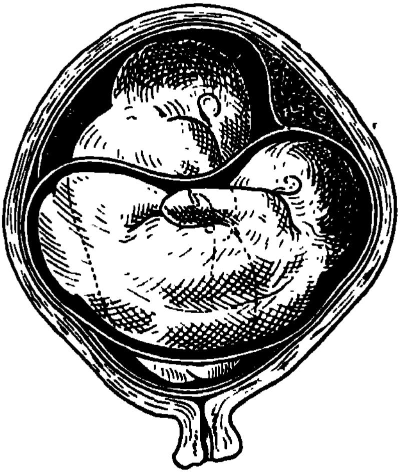

FIG. 348.—TWINS PRESENTING BY BREECH AND BACK.

however, distinguish between many forms of double monster and twins, as the former are, in fact, conjoined twins.

Auscultation. — On account of the difficulty of practising abdominal palpation in the case of twins where the uterus is more distended and hence more difficult to palpate than in a single pregnancy, we must rely largely on the results of careful auscultation. If two observers, listening at the same moment, hear, and count, two hearts which differ in rate both from one another and from the maternal heart, a certain diagnosis of twins can be made. Collins* was, we believe, the first to point out this fact, and MacClintock† supplemented it by diagnosing the existence of twins by hearing the pulsations of one fœtal heart, while

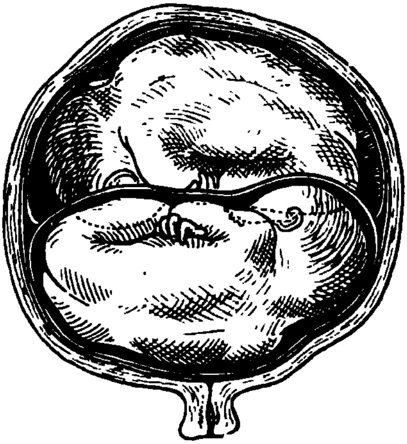

FIG. 349 —TWINS LYING TRANSVERSELY.

at the same time there was a prolapsed and pulseless funis in the vagina.

It will be found in practice that frequently the diagnosis of twins will not be made until one fœtus is born, and the uterus is found to contain another.

Course of Labour.—The usual sequence that occurs during the expulsion of twins is the birth of the first child, then the birth of the second, then the placenta of the first, and finally the placenta of the second. In rare instances the placenta of the first child follows the child, and then come the second child and its placenta. There is very rarely any difficulty in delivery, other than that which may result from a malpresentation, and even the latter condition is usually not so serious as in single pregnancies on account of the smaller size of the fœtus. Occasionally, the twins may become interlocked in such a manner as to prevent the expulsion of the first. The management of these cases will be subsequently discussed. As a rule, the interval between the birth of the two children is less than an hour. In cases in which the placenta of the first child follows it, however, there may be an indefinite interval, as, owing to the prematurity of the children, when once the uterus has got rid of one child, and consequently is no longer overdistended, the contractions may cease, and pregnancy may continue until full term.

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* 'A Practical Treatise on Midwifery,' p. 310.

† 'Practical Observations on Midwifery,' p. 320.

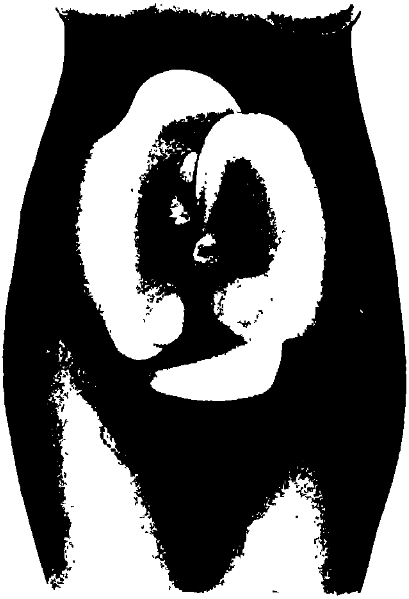

FIG. 350.—TWINS PRESENTING BY THE VERTEX AND BREECH AS FELT BY ABDOMINAL PALPATION.

The unshaded portion of the infants are those which are felt most distinctly.

The following table shows the interval between the birth of the first and second fœtus in 1,487 cases of twins recorded by Winckel :—

Interval.	Number of Cases.
None	364
15 minutes	386
30 ,,	301
30 to 45 minutes	52
45 to 60 ,,	156
1 to 22 hours	228

Management.—The only necessary variations from the management of normal labour may be mentioned in a very few words. If the first fœtus is in a longitudinal lie, allow it to be born. Then, palpate the uterus, or, if necessary, make a vaginal examination in order to determine the lie of the second fœtus. If this is longitudinal, do nothing; if it is transverse, perform podalic version and draw down a leg. Then, wait until thirty minutes have elapsed from the birth of the first child, and rupture the membranes, if they have not already ruptured spontaneously. Allow the second child to be born naturally, and conduct the third stage in the ordinary manner. It is usually unnecessary in twin cases to correct a face or breech presentation, or even a brow, as the small size of the fœtus will allow it to be born without difficulty. The object of rupturing the membranes is to ensure the birth of the second fœtus. As has been mentioned, if this is not done, it is quite possible that the contractions might pass off for several days or even weeks. Herman,* indeed, recommends that if the placenta of the first child follows it, pregnancy should be allowed to continue if it will, in order to ensure that the second child shall reach full term. We do not think, however, that this view will commend itself to the majority of obstetricians or of patients, inasmuch as such a course would necessitate all the trouble and pain of a second confinement. In exceptional cases, where the first child was very premature, it might be desirable to follow his advice, but the consent of the patient and her friends must first be obtained, and the reasons for so acting clearly explained to them.

The object of waiting for half an hour before rupturing the membranes is to afford the uterus time to contract down upon the second fœtus, and also to give it a short rest, in order that, when the contractions return, they may be sufficient not only to expel the fœtus, but to prevent the occurrence of hæmorrhage—a complication to which the overdistension of the uterus will always render the patient prone. If the second child is not expelled within an hour or so after the rupture of the membranes, it may be necessary to turn it into a pelvic presentation and deliver by traction on the legs, or to apply the forceps, according as may be thought best. If, however, there are sufficient contractions to cause the presenting part to fix, the expulsion of the fœtus can usually be effected by pressure upon the fundus—Kristeller's method.

A second ligature must in all cases be placed upon the funis of the first fœtus before the funis is divided. This procedure, which is only done for convenience in single pregnancies, is, in twin cases, necessary on account of the comparative frequence with which anastomoses are present between the placentæ of the two children. In such cases, if the second ligature was not applied, the second fœtus might readily bleed to death. It is also imperative to avoid all traction upon the first funis, as the two cords are occasionally interlaced, and traction upon the first might result in causing kinking of the second, and so cessation of the circulation through it.

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* *Op. cit.*

10 *Complications.*—The proportion of cases, in which some pathological condition occurs in association with twins, is considerably higher than the proportion in single pregnancies. The chief of these complications are as follows:—

1 **Malpresentations**—These have been already referred to.

2 **Interlocking.**—This will be discussed separately.

3 **Premature Delivery.**—This is a relatively common occurrence, as the following table will show. It is due to the overdistention of the uterus by the two children and sometimes by the excessive quantity of liquor amnii. The following table, from the statistics of Pinard, is based on the results of 150 cases:—

Duration of Pregnancy.*	Number of Cases.	Duration of Pregnancy.*	Number of Cases.
9 months - -	42	6½ months - -	9
8½ ,, - -	24	6 ,, - -	7
8 ,, - -	35	5½ ,, - -	5
7½ ,, - -	10	4½ ,, - -	1
7 ,, - -	14	4 ,, - -	3

5 **Hydramnios.**—An excessive amount of liquor amnii is not uncommon in twin pregnancies, particularly in cases in which the twins are developed from a single ovum. Its ætiology has been already discussed. As a rule, only one amniotic sac is affected, but more rarely both may be.

6 **Eclampsia.**—This condition is slightly more frequent in twin than in single pregnancies, due in all probability to the increased work thrown upon the kidneys by the presence of more than one fœtus, and also perhaps to the fact that the ureters are more compressed in their course through the pelvis in these cases.

7 **Placenta Prævia.**—It is only natural to expect that when the placental area is increased in size, the proportion of cases in which that area extends into the lower uterine segment will be also greater. Amongst sixty-two cases of placenta prævia recorded by Winckel, twins occurred three times, a proportion considerably in excess of the normal rate.

8 **Post-partum Hæmorrhage.**—According to Winckel, post-partum hæmorrhage occurs in 8·5 per cent of twin cases. This is probably in the main due to the overdistension and consequent paresis of the muscular fibres of the uterus. It may also be occasionally due to the fact that the placental area is larger than in single pregnancies, and that sometimes the placenta encroaches on the

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* Pregnancy is here considered to consist of nine calendar months.

lower uterine segment, where the arrangement of the muscle fibres is badly adapted to bring about the occlusion of the blood-vessels.

Fœtal Malformation.—An acardiac or an acephalic fœtus may sometimes occur in the case of twins derived from a single ovum, and in whom there is an anastomosis between their respective placental circulations. These conditions will be discussed later. Also, in cases in which the twins are derived from a single germinal area, they may be conjoined, and thus a double monster result.

Placental Anomalies.—Velamentous insertion of the cord is a common occurrence, and sometimes anastomosing vessels are found running over the membranes between the placentæ. Interlacing of the two cords may also occur, as has been mentioned, and may in some cases lead to the death of one or both of the children.

Prognosis.—The prognosis for the mother in twin cases is better than the foregoing list of complications would lead one to expect, and is only slightly worse than in normal labour. This is in great part due to the fact that the small size of the children renders delivery comparatively easy, even in cases of malpresentation. For the fœtus, however, the prognosis is considerably more serious. A certain number of children die *in utero*, particularly when derived from a single ovum, as a result of interference on the part of the stronger twin with the circulation of the weaker, or to the entangling of the cords. In such cases, one fœtus may die, and the other go to full term. The dead fœtus, if small, may then undergo fatty degeneration and eventually be converted into a mass of adipocere, or it may become mummified and flattened out against the uterine wall by the living child. To such a fœtus, the term *fœtus papyraceus* is applied.

Former statistics of the Rotunda Hospital [*] deal more fully with the mortality amongst twins than any other statistics with which we are acquainted, and consequently we make no excuse for reproducing Stephenson's [†] admirable summary of them:—

(1) The Influence of the Length of Interval between the Births.—In 262 cases the length of the interval was stated. The second child was born within fifteen minutes of the first in 46·5 per cent. of cases, and during the second quarter of an hour, in 30·2 per cent. of cases. That is to say, 76·7 per cent. were born within half an hour, 9·9 per cent. were born during the second half hour, and 13·3 per cent. were born more than an hour after the birth of the first. Of those born within the first half hour, 1 in 20 was still-born; of those born in the second half hour, 1 in 5; and of those born after an interval of an hour, 1 in 3·5.

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[*] As collected by Collins, Hardy and McClintock, and Johnstone and Sinclair.

[†] *Encyclopædia Medica*, vol. vi., p. 208, article by Professor W. Stephenson, Aberdeen.

(2) The Influence of the Presentation on the Mortality.—In the first born of the twins, the mortality of head presentation was higher, that of breech and footling presentation distinctly less, than in the same presentations in single births. In the second born, head presentations were nearly twice as fatal as in the first born—11 per cent. as compared with 6 per cent. In breech presentation, 2·5 per cent. only were lost. Of the children that lay transversely and were consequently turned, and of those that originally presented by the feet (132 in number), all were born alive.

(3) Total Infant Mortality.—Exclusive of non-viable and macerated children, the infant mortality in twin cases was 7·3 per cent. as compared with 2·7 per cent. in single births. Of the first children, 6·8 per cent. were still-born, of the second 7·8 per cent

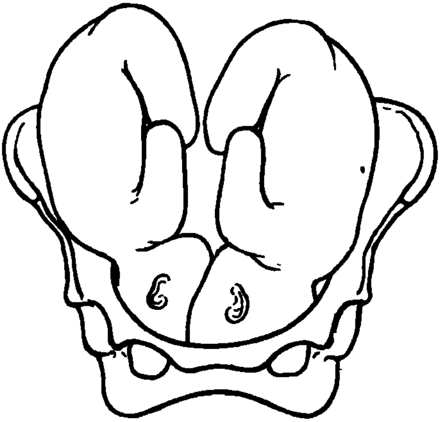

FIG. 351. LOCKED TWINS.

Two small heads have entered the pelvis together.

These statistics are very significant, but we cannot accept Stephenson's conclusion that 'instead of waiting half an hour, as text-books still recommend, before rupturing the membranes, the delivery of the child should be completed within that time.' It is difficult to understand how the second fœtus can come to any harm so long as its membranes are intact, and the advantage to the mother of waiting is obvious.

INTERLOCKING OF THE INFANTS.—Serious complications may sometimes arise as a result of interference with the mechanism of labour by the interlocking of one fœtus with the other. Such a complication may occur in several ways:—

(1) Each fœtus presenting by the head, both heads may—if small—enter the pelvis together and become impacted there (v. Fig. 351).

(2) The first fœtus presenting by the breech, the second by the head, the head of the second may pass into the pelvis with the trunk of the first, and thus lie below the head of the first. In such cases, impaction results from one of several causes:—

(a) Want of space in which to rotate, as in the former case.

(b) The chins become interlocked (v. Fig. 352).

(c) The chin of one fœtus is driven into the neck of the other (v. Fig. 353).

(d) Interlocking of the occiput.

(3) Each fœtus presenting by the head, one slightly in advance of the other, the head of the second may be driven into the neck of the first, and so prevent the further descent of the latter.

(4) One fœtus lying transversely, the other presenting either by its head or breech, the shoulder or chin of the one lying longitudinally may be driven down and interlock with the neck of the one lying transversely (v. Figs. 354, 355).

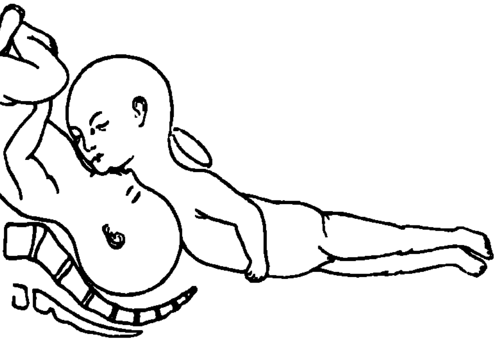

FIG. 352.—LOCKED TWINS.

The chin of the after-coming head of the first child has become interlocked with the chin of the fore-coming head of the second child

Diagnosis.—The diagnosis of these complications is made by vaginal examination and abdominal palpation. In the first complication, where two heads descend simultaneously into the pelvis, we find by abdominal palpation two trunks lying longitudinally in the uterus; while, by vaginal examination, we find two small solid tumours with the characteristics of the head occupying the pelvic cavity.

In the second complication, in which the after-coming head of the first fœtus interlocks with the fore-coming head of the second, we find on endeavouring to deliver the head of the first that, on introducing the fingers into the vagina, they come into contact with the head of the second fœtus, which is in the pelvic cavity or at the brim. The body of the second fœtus is also found by abdominal palpation, lying longitudinally in the uterus.

The recognition of the third complication is more difficult, as the interlocking head cannot be reached from the vagina, and the

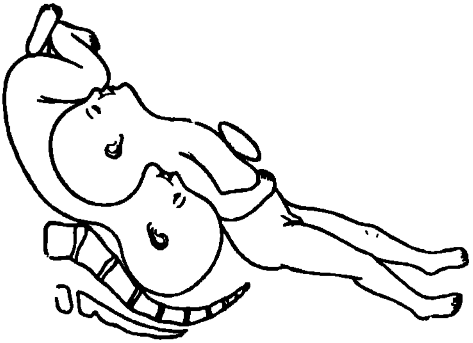

FIG 353.—LOCKED TWINS.

The occiput of the after-coming head of the first child has become interlocked with the chin of the fore-coming head of the second child

results of abdominal palpation, as will be readily understood, do not furnish any very definite information, save that the case is one

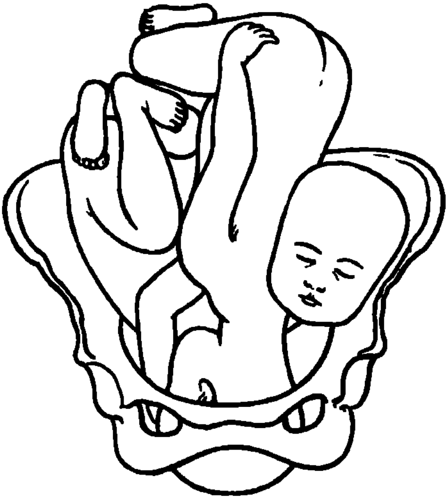

FIG. 354.—LOCKED TWINS.

The shoulder of the first child has been driven into the neck of the second child, who is lying transversely.

of multiple pregnancy. A diagnosis will as a rule not be arrived at until, owing to delay in delivery, an attempt is made to extract the head in the pelvis with the forceps, when the resistance offered to its descent will attract attention. In all such cases, the hand should be introduced into the vagina and the fingers passed above the head to determine the nature of the resistance.

In the case of the fourth complication, the diagnosis will be made in a similar manner, but here abdominal palpation may afford more assistance, as it will show that the second fœtus

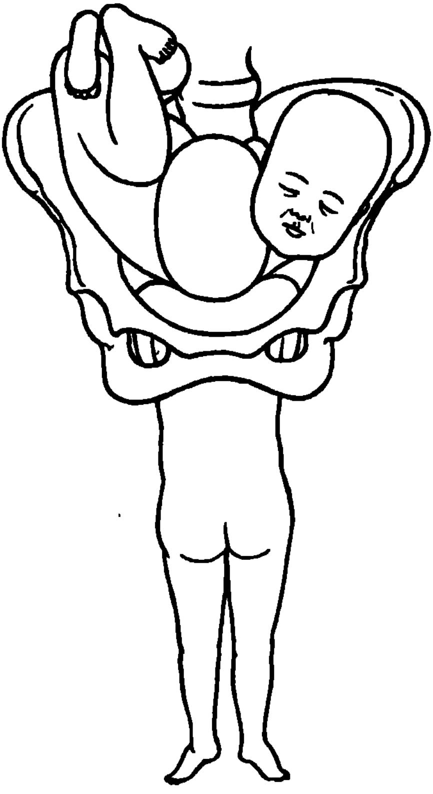

FIG. 355.—LOCKED TWINS.

The chin of the after-coming head of the first child has interlocked with the neck of the second child, who is lying transversely.

is lying transversely—a lie which should always suggest the possibility of a complication.

Treatment.—When two heads have descended together into the pelvis, and become impacted there, we must endeavour to push up one above the brim. The other will then descend lower and be delivered. If it is found to be impossible to keep the second head out of the pelvis while the first is being born, the first fœtus should be turned and extracted, but such a course is rarely necessary.[c] If neither of the heads can be pushed upwards, forceps may be applied to the head which is lowest, and an attempt made to extract it.[d] If this fails also, one head must be perforated, and as the fœtus to which the forceps has been applied has been subjected to the greater amount of violence, its head should be the one to be sacrificed.

When the after-coming head of the first fœtus becomes interlocked with the fore-coming head of the second,[a] the second head must, if possible, be set free and pushed upwards. The first head can then be extracted.[e] If this cannot be done, and if the children are small, an attempt may be made to extract the second fœtus with the forceps past the body of the first, and then to deliver the first. If this also fails, the first fœtus must be decapitated, its head pushed upwards, then the second fœtus extracted, and lastly the head of the first. The first fœtus should always be decapitated in such a case, as, owing to the pressure its funis has undergone, it is almost certainly dead.

When both children present by the head, and the head of the second is driven into the neck of the first, the head of the second should be pushed upwards, and the first fœtus then extracted with the forceps.

When the first fœtus presents by the head, and its shoulder becomes locked against the neck or body of the second, which is lying transversely, an attempt must be made to push away the body of the second fœtus with the fingers passed into the uterus. If this can be done, the first child is extracted with the forceps, and then the second turned and extracted. When the first fœtus presents by the breech, and its chin becomes locked against the neck of the second, which is lying transversely, the treatment is similar, and we attempt to push away the body of the second, and then to extract the first. If that is not possible, the first must be decapitated, its body removed, then the second fœtus turned and extracted, and lastly the head of the first removed.

CHAPTER VII

COMPOUND PRESENTATIONS—PRESENTATION AND PROLAPSE OF THE CORD

Compound Presentations—Presentation of a Hand or Arm with the Head—Presentation of the Foot or Feet with the Head—Presentation of Hands and Feet—Presentation of a Hand with the Breech. Presentation and Prolapse of the Cord—Treatment—Reposition—Podalic Version—Immediate Delivery.

COMPOUND PRESENTATIONS

UNDER the term Compound Presentations we include the following conditions:—Presentation of a hand or arm with the head. Presentation of a foot or feet with the head. Presentation of a hand and foot or hands and feet together. Presentation of a hand with the breech.

PRESENTATION OF A HAND OR ARM WITH THE HEAD.

In this presentation, the head presents and the hand or even the arm is prolapsed alongside it, so that the one or the other is felt from the vagina. In some cases, it may be possible to feel only the tips of the fingers, and this, perhaps, is commonest. In other cases, the hand, or even the entire forearm, may lie below the head. In very exceptional cases, the arm may lie behind the head in relation to the occipital prominence. This condition is also known as nuchal position or dorsal displacement of the arm, and was first described by Simpson.* It is closely akin to the nuchal position of the arm which sometimes occurs in breech presentation, and which has been already alluded to.

Frequency.—The proportion of cases in which the hand is found beside the head varies considerably according to the statistics of different writers. Thus, at Guy's Hospital, amongst 22,980 births, the proportion of cases in which the hand had descended was only one in 425, while, according to various aggregated continental statistics,† the proportion amongst 12,202 cases was one in 55·7. In the latter statistics, however, all cases in which the hand prolapsed beside the head are included, whether it was accompanied by a foot or not, while it is possible that the Guy's Hospital statistics refer to cases of prolapse of the hand alone. Still, even if cases in which there was an associated prolapse of a foot or feet are excluded, the continental statistics show a very much higher rate.

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* *Edinburgh Monthly Journal*, April-May, 1850.

† Hugenberger, St. Petersburg. Pernice, Hallé. Winckel, Dresden.

Causes.—The same conditions, which we have already noticed as causes of malpresentations of the fœtus, and especially those which prevent the head from descending into the lower uterine segment, may also be the cause of prolapse of the hand or arm. The chief of these causes are 1 flattened pelvis, 2 obliquities of the uterus and pendulous abdomen, 3 twins, 4 and an unusually large or a very small fœtal head. 5 The sudden escape of the liquor amnii in hydramnios is a not uncommon cause, as the rush of fluid may carry down a limb.

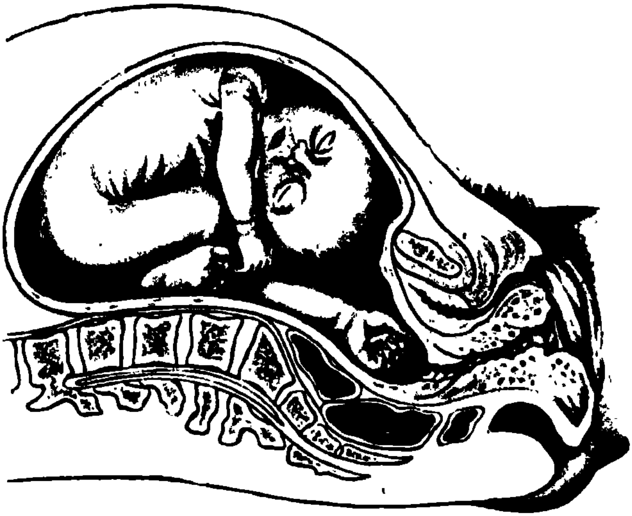

FIG. 356.—PRESENTATION OF AN ARM WITH THE HEAD.

Note also the associated presentation of the posterior parietal bone (anterior asynclitism). (After Schaeffer.)

Diagnosis.—The diagnosis can be only made by vaginal examination. If the hand is beside the presenting part, it is readily felt. When, however, it is behind the back—the nuchal position, the condition will not be recognised until after the birth of the head, unless it obstructs delivery. Then, the condition may be determined by passing the fingers above the presenting part and feeling the arm as it lies behind the neck.

Effect on Labour.—The prolapse of an arm alongside the head may affect labour in one of three ways. If the head is still free above the brim, the prolapse may bring about a change of presentation from a vertex to a shoulder (Michaelis*) or to a face presentation (Winckel†). If the head has descended into the brim, the presence of the arm may cause a descent of the posterior parietal bone, or may cause increased difficulty in or complete arrest of delivery, owing to the greater size of the presenting part, which has to pass through the pelvis. On the other hand, in the case of a small fœtal head or a large pelvis, labour may be unaffected, or, in some cases, as the head descends, the prolapsed hand may be retarded by the friction of the pelvic wall, and so brought back again into its proper position as the head descends. A nuchal position of the arm may result in this manner, the forearm being pushed upwards and backwards by the pelvic brim or walls.

Treatment.—If the prolapse of a hand or arm is discovered while the head is still free above the brim and the membranes unruptured, it may be possible to bring about the correction of the condition by the postural method. Place the patient upon the side opposite to that on which the limb has prolapsed, with the view of correcting the obliquity of the fœtus which caused the prolapse and at the same time of drawing up the limb. If this procedure is successful, keep the patient in this position until the head descends into the brim. If the procedure is unsuccessful, pass the hand into the vagina, and endeavour to replace the arm. This can usually be done if the head is not fixed, but it is not always possible to keep it up. As soon as the arm has been replaced, push the head into the brim, and if it descends into and fills the latter maintain it in this position by means of a tight abdominal binder. If, however, it does not fill the brim, and there is room for the arm to again descend beside it, examine the patient vaginally in a short time, and, if the arm has again prolapsed, perform podalic version and bring down a foot. If, however, the head is very small in comparison with the pelvis, the arm may be allowed to remain prolapsed, as its presence will not interfere with delivery. If the nature of the case is not recognised until the head has passed the brim, and, consequently, reposition is impossible, leave the case to Nature, until some indication for immediate delivery appears. Then, the forceps may be applied, and the fœtus extracted. In such cases, care must be taken to so apply the forceps that the prolapsed hand or arm is not included between the blade and the fœtal head.

In replacing a prolapsed arm, the patient may be placed upon the side at which the arm is found, as the weight of the fœtal body will then tend to carry the head to the opposite side, and this will provide more room for the operator's hand. As soon as the arm has been completely pushed above the head, the patient may be again placed on the opposite side to that at which the prolapsed limb lay, in order to correct the fœtal obliquity.

* 'Das engen Becken,' etc., p. 184. † *Op. cit.*, p. 384.

The management of a case of nuchal position of the arm is more difficult. If the head is free, Sir J. Simpson, who described the condition,* recommended to draw the arm down beside the head, when the case becomes identical with that we have just described, and may be treated accordingly. Another method consists in rotating the head with the hand in the vagina in the direction to which the fingers of the displaced hand point, in the hope that the friction of the soft parts may, by keeping the arm steady, restore the normal relations. Herman considers that podalic version is preferable to either of these methods, but, if this is to avail so far as the fœtus is concerned, the arm must still be replaced, as a nuchal position is almost equally difficult to manage when it occurs with an after-coming head. It is most unlikely that a nuchal position of the arm will be recognised until the head has descended into the pelvis, inasmuch as it will in all probability not cause any obstruction prior to this, and then, save in the case of a very small head, even reposition will be impossible. In many cases, a nuchal position will not be recognised, and in such cases the application of the forceps is usually necessary on account of delay, or, if delivery by the forceps is impossible, we may be compelled to perform perforation.

Prognosis.—In the cases of prolapsed arm or hand at Guy's Hospital, to which we have already alluded, 14·8 per cent. of the children were born dead. In nuchal position of the arm, the fœtal mortality is probably considerably higher.

PRESENTATION OF A FOOT OR FEET WITH THE HEAD.

In this presentation, the fœtus is so doubled upon itself that one or both feet come to lie at the level of, or even slightly below, the presenting head.

Frequency.—Amongst the 12,202 continental cases to which we have referred in the preceding sections, presentation of the foot or feet alongside the head occurred in 14, a proportion of one in 871·5. In several of these cases there was an accompanying prolapse of one or both hands.

Ætiology.—The causation of this condition is probably very similar to that of presentation of the hand and head. It may also occur, temporarily, during the performance of combined or internal podalic version.

Diagnosis.—The diagnosis can be only made by vaginal examination, though the presence of a prolapsed foot may be suspected from the results of abdominal palpation.

Effect upon Labour.—The probable effect upon labour of the prolapse of a foot beside the head is that the latter is gradually pushed away from the pelvic brim, while the arm descends deeper, a presentation of the arms and feet eventually resulting, and a transverse lie of the fœtus.

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* *Edinburgh Monthly Journal*, April-May, 1850.

Treatment.—If the membranes are intact, the breech must be pushed by external manipulations to the fundus, and the head into the brim. The fœtus may be then maintained in this position by an abdominal binder, supplemented if necessary by pads placed at each side of the fœtal body with the object of maintaining its longitudinal lie. If this procedure is impossible, or if the foot again descends, podalic version must be performed, the foot drawn down, and the head pushed up to the fundus.

C PRESENTATION OF HANDS AND FEET.

This condition is only a variety of a transverse lie of the fœtus, and need not be discussed again.

PRESENTATION OF A HAND WITH THE BREECH.

This is not a condition of any great importance, as there is usually ample room for a hand to pass through the pelvis beside the breech on account of the compressible nature of the latter. Further, in many cases, as the breech descends, the hand will be pushed up by the pelvic brim. Presentation of the hand with the breech occurred 7 times in 8,210 cases of labour recorded by Hugenberger,* a proportion of one in 1174·3.

PRESENTATION AND PROLAPSE OF THE UMBILICAL CORD

Presentation of the cord is the term applied to the condition in which the cord lies below the presenting part, the membranes being still unruptured. Prolapse of the cord is the term applied to the same condition after the membranes have ruptured (Fig. 357).

Frequency.—The relative frequency with which presentation and prolapse of the cord occurs in different hospitals and countries varies very greatly. As will be seen when discussing the ætiology of these conditions their frequency is very closely connected with the proportion of cases of contracted pelvis, as the latter condition both itself predisposes to prolapse and presentation, and also predisposes to conditions—such as malpresentations—which themselves favour prolapse. The total of three aggregated sets of German statistics† show that prolapse occurred 135 times out of 10,903 cases—a proportion of one in 80·7, while, according to statistics collected by Churchill, it occurred 304 times out of 50,061 cases, a proportion of one in 164. According to the statistics of the Rotunda Hospital for the last fourteen years, prolapse occurred 130 times in 20,000 cases of labour, a proportion of one in 153·84. Presentation of the cord is considerably rarer than is prolapse.

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* 'Bericht über das Gebärhaus der Grossfürstin Helene Paulowna,' 1863, p. 16.

† Hecker, Abegg, and Credé.

Ætiology.—Presentation of the cord differs somewhat from prolapse in its ætiology. All cases of presentation become cases of prolapse as soon as the membranes rupture, unless the cord has been previously replaced, but the majority of cases of prolapse do not commence as cases of presentation. Presentation is, so to speak, a primary condition, that is, it is present at the commencement of labour. In most cases of prolapse, on the other hand, the cord usually occupies a normal position above the presenting part until the membranes rupture, when it is swept down by the escaping liquor amnii.

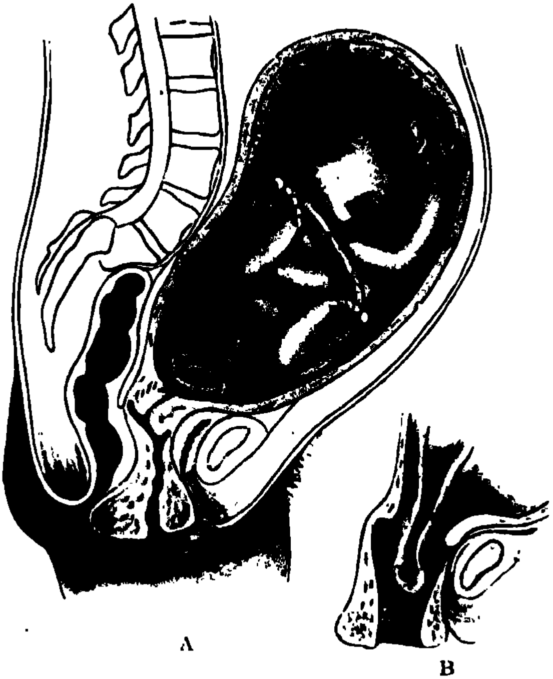

FIG. 357.—PRESENTATION AND PROLAPSE OF THE UMBILICAL CORD.
A, Presentation of the cord; B, prolapse of the cord. Note the presence of pelvic contraction.

Presentation of the cord, as a rule, results from one of three conditions:—An abnormally long cord; a velamentous or marginal insertion of the cord; and an abnormally low situation of the placenta. Hecker[*] found that in cases of presentation of the cord associated with a head presentation, the average length of the former was a little above twenty-eight inches. As the average length of the cord is only twenty-two inches, this means an average difference of six inches. Another observer (Hugenberger) has shown that marginal insertion is found three times as often in cases of presentation of the cord as is central insertion. Presentation of the cord also occurs more frequently in cases of low insertion of the placenta than in cases of its normal insertion, and Winckel met with four cases amongst sixty-two cases of placenta prævia.

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[*] 'Deutsche Klinik,' I. 165; and II. 103.

Prolapse of the cord is the natural sequence of presentation in cases in which the presentation is not replaced, but this is not its common cause. Prolapse, as a rule, is the result of a combination of two conditions:—a presenting part which does not fill the lower uterine segment, and a sufficient amount of liquor amnii to create the force necessary to carry the cord below the presenting part when the membranes rupture. The necessity for the presence of these two conditions is very obvious. If the presenting part fills the lower uterine segment completely, the liquor amnii which is round the body does not escape when the membranes rupture, as the presenting head acts as a ball-valve and prevents it from doing so; consequently, there is neither room for the cord to prolapse nor force to drive it downwards. Moreover, even if the presenting part does not fill the lower segment, the cord will not prolapse unless there is some force to drive or carry it down. This force is supplied by the sudden rushing away of the liquor amnii, and, if the latter is scanty in amount, the necessary force is wanting and prolapse does not occur. These two conditions may then be regarded as invariably present in all cases of prolapse of the cord occurring independently of a previous presentation, that is, as the cause of the greater proportion of cases. The various conditions, which interfere with the normal adaptation which should exist between the presenting part and the lower uterine segment, will thus be always found associated, as predisposing factors, with prolapse of the cord, the actual exciting cause being in every case the sudden rushing away of the liquor amnii. The principal predisposing factors are as follows:—

(1) Pelvic Contraction.—Pelvic contraction favours prolapse of the cord both *per se* by preventing the descent of the head into the lower uterine segment, and on account of the abnormalities which it tends to cause in the presentation of the fœtus. Winckel met with prolapse of the cord in ten per cent. of cases of contracted pelvis, while other writers state the percentage to be even higher.

(2) Faulty Conditions of the Uterus.—Any abnormality of the uterus that prevents the descent of the head into the lower uterine segment or that favours the occurrence of malpresentations also predisposes to prolapse. Such abnormalities are mechanical obstacles to descent, as myomata, extreme laxity of the uterine muscle, and many of the various forms of maldevelopment. As

is to be expected, prolapse occurs more frequently in multiparous women than in primiparæ, and the result of various collected statistics* shows that it occurs about three and a half times as frequently in one as in the other.

(3) Malpresentation of the Fœtus.—A vertex presentation alone is properly adaptable to the shape of the lower uterine segment. All other presentations fill the lower segment more or less incompletely, and, consequently, afford room for the descent of the cord if the liquor amnii escapes suddenly. It is instructive to compare the relative frequency of the different presentations, first, in all cases of labour, and, secondly, in cases complicated by prolapse of the cord, as such a comparison shows very clearly the influence of malpresentations:—

	Vertex.	Breech.	Face and Brow.	Shoulder.
Usual percentage of presentations	95·53	3·11	0·8	0·56
Percentage in cases of prolapse of cord†	56·3	25·2	1·0	17·5

Faulty attitude of the fœtus, such as the prolapse of a limb, also favours prolapse of the cord.

(4) Multiple pregnancy, abnormalities in the development of the fœtus, excessive quantity of liquor amnii, and low insertion of the placenta, may finally be all grouped together as predisposing causes of prolapse, as they all tend to a greater or less degree to prevent the normal adaptation of the presenting part to the lower uterine segment. In the case of hydramnios, there is the additional exciting factor of an increased rush of liquor amnii when the membranes rupture.

Consequences.—Presentation or prolapse of the cord has no effect on the mother, but the effect on the fœtus is very considerable. During each contraction of the uterus, the presenting part is driven downwards and presses against the cord. This pressure is not sufficient to be of any consequence until the membranes rupture, but, as soon as this occurs, the cord is compressed between the presenting part and the undilated portion of the cervix—if dilatation is not complete, or, if the head has descended into the pelvic cavity, between the presenting part and the pelvic wall. Such compression obstructs the circulation in the umbilical vessels, and, unless relieved rapidly, brings about a slowing of the fœtal heart, followed by its gradual cessation and the consequent death of the fœtus.

Diagnosis.—The diagnosis of prolapse or presentation of the cord can be readily made by vaginal examination. In presentation, the cord is felt below the presenting part and is recognised by its characteristic shape and by the fact that it pulsates if the fœtus is alive. In prolapse, a loop of the cord has usually descended into the vagina, or it may pass through the vulva and be found externally. In cases in which it has not been compressed, it is full of blood and pulsates, but, if the death of the fœtus has occurred, it is usually more or less flaccid. Presentation of the cord may pass unrecognised when the presenting part of the fœtus is some little way above the uterine orifice, as the cord may not be reached by the examining finger. If it is felt, however, it cannot be mistaken for anything else, as its shape is characteristic.

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* Winckel, *op. cit.*

† Winckel—collected cases.

Presentation or prolapse of the cord cannot be diagnosed by abdominal palpation. The attention of the obstetrician will, however, be drawn to the possible presence of such a condition if he finds the presenting part free above the brim at a time at which it ought to be fixed. Auscultation of the fœtal heart may sometimes lead to a diagnosis. If we find that the rate of the heart diminishes very considerably during a contraction of the uterus, while it is more rapid than normal in the interval between the contractions, it is strong evidence that intermittent compression of the cord is occurring. Such compression may result from causes other than presentation or prolapse, but these conditions are its most common cause. Under normal circumstances, the fœtal heart-rate falls during a contraction from 140 beats per minute to from 80 to 68, while, in cases in which the cord is compressed, the rate may fall from 150 to 160 between the contractions to 45 to 50 during the contraction. The presence of a funic souffle is also suggestive of compression of the cord, and this compression may be due to presentation or prolapse.

Treatment.—When presentation or prolapse of the cord occurs, the death of the fœtus will almost certainly result during the stage of expulsion in consequence of the pressure on the cord, unless the condition is remedied or the stage is very short. So long as the membranes remain intact, the danger of compression is not very great, but, once their rupture occurs, compression usually immediately results. There is one favourable circumstance attending these cases, and to which many infants owe their life. The same conditions which favour prolapse of the cord, *i.e.*, a want of adaptation between the presenting part and the lower uterine segment, tend to minimise the danger of compression during the early part of the stage of expulsion. The reason of this is that the same condition that prevents the presenting part from exactly filling the lower uterine segment, also prevents it from exactly filling the pelvic brim or cavity, and that, consequently, there may be sufficient room at one side of the pelvis for the prolapsed cord to lie without being compressed. Presentation or prolapse of the cord is almost always fatal to the fœtus when it occurs in a patient in whom the pelvis is normal, and in association with a vertex presentation, unless the stage of expulsion is very short indeed. On the other hand, the fœtus has a fair prospect of escape when prolapse occurs in the case of a slightly contracted pelvis, and in association with a pelvic presentation. Indeed, so good is this prospect, that, as we shall see, a recognised method of treatment in these cases is the substitution of a pelvic for a cephalic presentation.

In discussing the treatment, we need not differentiate between presentation and prolapse, but will for the time include them both under the term prolapse.

Prolapse of the cord may be treated in one of the following ways, according to the exact conditions present:—Reposition, the cord being replaced above the presenting part; the substitution of a pelvic presentation for a cephalic presentation; or immediate delivery.

Reposition.—By the reposition of the cord is meant its replacement above the presenting part, in order that it may not be compressed during labour. Reposition can be effected in one of three ways:—Postural reposition; manual reposition; or instrumental reposition.

(1) Postural Reposition.—Postural reposition is effected by placing the patient in such a position that the fœtus and the cord tend, under the influence of gravity, to drop towards the fundus of the uterus, and so to draw away from the uterine orifice the portion of cord that is presenting. In order that it may be successfully carried out, the membranes must be intact, that is to say, the case must be one of presentation of the cord, and the presenting part must not be fixed in the pelvic brim. If these conditions are present, the method may be given a trial, as, if it succeeds, it offers the best prospect of saving the life of the fœtus, and at the same time is free from danger so far as the mother is concerned, as it does not necessitate any intra-uterine interference. The best position in which to place the patient is the knee-chest position, in which she kneels, and then bends forward until her chest is almost in contact with the bed (*v.* Fig. 192). The uterus then falls forward under the influence of gravity and becomes almost vertical, and the presenting part and the cord tends to fall away from the uterine orifice. The fingers are then passed into the vagina, and an examination is made to ascertain whether the cord has slipped back. If it has not done so, the presenting part is pushed away from the brim, and the fœtus moved from side to side by pressure applied by an assistant through the abdominal wall. By this means, the cord may be made to fall back. If, on the other hand, the cord has fallen back, the assistant presses the presenting part into the pelvic brim, and the patient is at the same time gently turned over and placed again in the dorsal position. The fingers are kept in the vagina during this movement to ascertain that the cord does not again fall down. If it remains up, and if the os is at least half dilated, the membranes may be ruptured. The presenting part must then be kept in the

brim until the uterine contractions fix it, either by manual pressure applied through the abdominal wall, or by means of a tight abdominal binder. If the cord again prolapses as soon as the patient is brought back to the dorsal position, it is better to again place her in the knee-chest position and to keep her in it until the contractions fix the presenting part. Some patients, however, would find it a physical impossibility to stay for long in such a position, and, in their case, a modified Trendelenburg position may be substituted. A ready means of extemporising a support which will keep the patient in the latter position consists in laying a wooden chair on its face along the bed in such a manner that the back forms an inclined plane. The back is then padded with pillows, and the patient is placed on it as shown in Fig. 193. She must remain in this position until the presenting part is fixed, and then she may be allowed to return to the dorsal position.

(2) Manual Reposition.—Manual reposition—the reposition of the cord by the hand or fingers passed into the uterus—may be tried in all cases in which postural reposition fails, and in which the necessary conditions for its performance are fulfilled. These conditions are that the presenting part is not fixed in the pelvic brim, and that the uterine orifice is sufficiently dilated to allow the hand to be introduced as far into the uterus as is necessary. Manual reposition will be best performed with the patient in the knee-chest position, unless an anæsthetic has to be administered, when Trendelenburg's position is more suitable, as it is easier to maintain her in it. An anæsthetic is usually necessary, as the introduction of the hand into the vagina makes the patient strain, and straining renders reposition impossible. The hand is introduced into the vagina, with the fingers in the shape of a cone, and, if the membranes are intact, an attempt may be made to replace the cord without rupturing them. To do this, two or three fingers are passed through the uterine orifice and the presenting part is pushed upwards. The fingers then surround the presenting loop of cord and push it also upwards, together with the intervening membranes, until it is past the greatest convexity of the presenting part. If this process succeeds, the membranes are punctured with a stylette passed along the fingers which are still in the uterus, and the liquor amnii is allowed to escape as slowly as possible. The fingers are then gradually withdrawn, the other hand pushing the presenting part after them into the brim. If this manœuvre fails, the membranes must be ruptured, and the prolapsed loop grasped in the hand and carried upwards above the presenting part as before, and then the presenting part pushed down. All efforts at reposition must be made in the interval between the contractions. If manual reposition cannot be effected, instrumental reposition may be tried, but it is unlikely to succeed. If it also fails, the only treatment that offers much prospect of success is immediate delivery, either by extraction as a pelvic presentation or by the forceps.

(3) Instrumental Reposition.—Reposition by means of any of the many forms of repositor, specially manufactured or improvised, is a very difficult process, and one which but seldom succeeds. For its performance, the same conditions must be present as for manual reposition, save that the uterine orifice need not be so widely dilated, as it ought to be possible to replace the cord in any case of prolapse through an orifice which was sufficiently dilated to allow the prolapse to occur. Many forms of specially devised repositors have been made from time to time, but none of them has proved itself anything superior to—if as good as—the implements that can be improvised from a gum-elastic catheter. The most suitable implement consists of a new No. 10 or 12 gum-elastic catheter with a stout stylette, and some common white tape which has been sterilised by boiling. A piece of tape eight inches long is taken, and the ends knotted together. A loop of this is then pushed into the eye of the catheter, from which the stylette has first been partially withdrawn, and the stylette again pushed fully into its place, in such a manner as to pass through the loop and hold it in the eye. The remainder of the tape is then passed round a loop of the cord, as shown in Fig. 358, and its end pushed over the top of the catheter. In this way, the cord is attached to the catheter by a fastening which will not open so long as the catheter is being pushed upwards, but, as soon as the catheter is withdrawn, the tape will again slip over the top of the catheter and set the cord free. As soon as the tape has been so adjusted as to snare a large loop of the cord, the catheter is passed into the uterus beside the presenting part and is pushed upwards as far as it will go. If it meets with an obstruction before it has penetrated sufficiently into the uterus, it

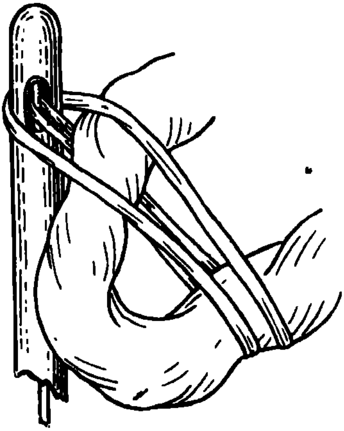

FIG. 358.—METHOD OF USING CATHETER-REPOSITOR.

is slightly withdrawn and pushed up in a different direction. If it succeeds in carrying the cord above the presenting part, the latter is pushed down into the brim and the catheter then gently withdrawn. Another method of using it consists in tying a loop of tape loosely round a coil of the cord, and then passing an end of the loop into the eye of the catheter as before. The catheter is then pushed upwards, and, as soon as the cord is in its proper place, the loop is set free by withdrawing the stylette, and the catheter itself is drawn down. Instrumental reposition is simple to describe, but difficult to perform. It should, however, be tried if there is no other suitable method of treating the case, and sometimes it may succeed.

Podalic Version.—Podalic version is indicated in cases of prolapse of the cord in which reposition has failed or is impossible, and in which the degree of dilatation of the uterine orifice is not sufficient to permit the extraction of the fœtus as a head presentation by the forceps. The usual conditions that are required for the performance of version must be present, *i.e.*, the presenting part must not be fixed, and the uterine orifice must be sufficiently dilated to allow the introduction of two fingers, or if bipolar version is impossible—of the whole hand. The object of performing podalic version, in cases in which a cephalic presentation is associated with prolapse of the cord, is to substitute for the head a part of the fœtus which is smaller and softer, and so to lessen the compression on the cord. When the fœtus is turned into a pelvic presentation and a foot brought down, there is usually a space at one side of the sacrum of the mother where the cord can be placed. There is also another object in performing version, that, if the pulsations of the cord become feeble, we can extract the fœtus at any moment by traction upon the leg. In performing version, the fœtus should be turned in the reverse direction to that ordinarily adopted. Under other circumstances, the pelvis is brought over the brim by the shortest route, *i.e.*, the head is pushed in the direction of the fœtal back, and the breech in the opposite direction. This procedure, as will be readily understood, tends at one stage to bring the umbilicus nearer to the pelvic brim than it was before, and so to favour the descent of more of the cord. If, however, the fœtus is turned the reverse way, *i.e.*, if the head is pushed in the direction of the fœtal chest, and the breech in the opposite direction, the umbilicus will be carried further away from the pelvic brim than it was before. As the leg is brought down into the vagina, the prolapsed loop of cord should be placed at the sacral end of the oblique diameter opposite to that in which the back of the fœtus lies, *i.e.*, if the bi-trochanteric diameter of the fœtus corresponds to the right oblique diameter of the brim, the cord should be placed near the left sacro-iliac joint.

Immediate Delivery.—Immediate delivery is the final resource at the disposal of the obstetrician when reposition of the cord has failed and podalic version is either impossible or has been performed without benefit. In the case of a head presentation delivery is effected by the forceps, in the case of a pelvic presentation by traction on a leg. If the head presents, and the forceps is to be applied, the uterine orifice must be sufficiently dilated to allow the passage of the head without laceration. If it is not sufficiently dilated, and if the head is fixed and so version is impossible, it must be dilated manually or incised. There is no time in such cases for the use of hydrostatic or mechanical dilators. Cases of this kind, in which the head is fixed, the os insufficiently dilated to apply forceps, and the fœtus still alive, are rare, but, when they do occur, they are most difficult to treat. Rapid extraction with the forceps is unjustifiable, as it exposes the mother to too great risk. Slow extraction, giving the orifice time to dilate, is useless, as the fœtus will be dead before it is delivered Manual dilatation rapidly performed, or incision in cases where the edges of the uterine orifice are thin, as in primiparæ, followed by the application of the forceps, is the only treatment which can be adopted. Once traction with the forceps has been commenced, it must be rapid, as the cord is compressed during the entire time the head is passing through the pelvis, and, if this compression is continued for more than two or three minutes, the fœtus will be born dead. In applying the forceps, care must be taken not to include a loop of the cord between the blade and the head of the fœtus.

Extraction in the case of a pelvic presentation calls for little special comment. It should not be commenced until it is necessary, as shown by weakness or cessation of the contractions of the cord, as it is always difficult to extract a fœtus quickly through an imperfectly dilated os, and, if the process is slow, the death of the fœtus may result. There is also a risk of cervical laceration. If, however, the pulsations of the cord show that compression is occurring, extraction must be performed as slowly and carefully as is consistent with the safety of the fœtus. In a pelvic presentation, however, compression of the cord, as a rule, will not occur until the breech has descended into the pelvis, and at that stage the os will be nearly or quite fully dilated.

The treatment of presentation and prolapse may be summed up in a few words. In all cases, first think of the possibility of performing reposition. If the membranes are intact, this may be done by the postural method, or, failing this, by the manual or instrumental method; if the membranes are ruptured, the manual or instrumental method will alone succeed. If reposition by any method is impossible, and the head presents but is not fixed, perform podalic version and draw down a foot. So long as the pulsations of the cord show that there is no compression, leave delivery to the natural efforts, but, if compression occurs, extract at once. If podalic version is impossible, and if the uterine orifice is sufficiently dilated, extract the fœtus with the forceps. If the orifice is not sufficiently dilated, dilate it manually or incise

Occasionally, a case may occur where the condition may be left untreated, even though the fœtus is alive. If the patient has had many children, and if the genital passages are roomy, the fœtus small, and the uterine contractions strong, delivery may be left to the natural efforts, as the second stage will probably be of very short duration and can be further shortened by pressure on the fundus. The obstetrician must, however, watch the case most closely, and be ready to apply the forceps the moment any signs of delay or of compression occur.

Prognosis.—The maternal prognosis in cases of presentation and prolapse of the cord is not materially affected, save so far as the operative procedures undertaken to save the fœtus may prove prejudicial, either by causing laceration of the soft parts or septic infection. The fœtal prognosis is, however, directly made more serious. The aggregated statistics of several continental clinics show that out of 1,376 cases of presentation or prolapse, 657 infants were born dead, or a percentage mortality of about fifty. The following table shows the results obtained by the different modes of treatment in about 400 cases of presentation and prolapse (Massmann[*]):—

ORIGINAL PRESENTATION.	TREATMENT.	PERCENTAGE.	
		Lived	Died.
Vertex	Left to nature	34	66
,,	Forceps	61	39
,,	Version and extraction	46	54
Pelvic	Left to nature	50	50
,,	Extracted	58	42
Shoulder	Version and extraction	49	51
Various presentations	Reposition	71·72	29·28

A table constructed on somewhat similar lines from the reports of the Rotunda Hospital gives the following results:—

TREATMENT ADOPTED.	PRESENTATION.				NO. OF CASES.
	Vertex.	Pelvic.	Face.	Shoulder	
Left to nature	22	18	1	—	41
Forceps	25	—	—	—	25
Version and extraction	15	—	—	10	25
Reposition	5	—	—	1	6
Extraction alone	—	18	—	—	18
Infants born alive	33	22	1	7	63
,, ,, dead	34	14	—	4	52[†]

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[*] *Petersburger Med. Zeitsch.*, xiv., Nos. 3, 4, 1868

[†] Of these infants, 21 were dead before the cases came under treatment.

CHAPTER VIII

ANOMALIES OF FŒTAL DEVELOPMENT

Excessive Size of the Normally Shaped Fœtus—Of the Entire Fœtus—Of the Shoulders. Excessive Size of the Fœtus due to Disease—Hydrocephalus—Hydromeningocele, Hydrencephalocele, Encephalocele—General Fœtal Œdema, Hydrothorax, Ascites—Abnormalities of the Urinary Organs—Spina Bifida—Sacro-coccygeal Tumours—Cystic and Solid Tumours of the Neck—Tumours of the Liver and Spleen. Monsters—Single Monsters—Double Monsters.

EXCESSIVE SIZE OF THE NORMALLY SHAPED FŒTUS

A NORMALLY shaped fœtus may give rise to difficult labour owing to its excessive size as a whole, or to the excessive size of the shoulders.

EXCESSIVE SIZE OF THE ENTIRE FŒTUS.—The fœtus may sometimes reach so great a size *in utero* that its passage through the pelvis is a matter of difficulty or impossibility. It is impossible to fix any limit above which a fœtus is too large to be expelled naturally, and below which it can be so expelled, as so much depends upon the size of the pelvis, the powers of the mother, and the size and ossification of the fœtal head, but, speaking generally, any fœtus which exceeds eleven pounds in weight is likely to cause a difficult labour.

We have already discussed the various factors which tend to influence the weight of the fœtus, and need not again refer to them (*v.* p. 108).

Diagnosis.—It is usually impossible to determine the presence of an abnormally large fœtus until delay in labour leads us to pass the hand into the uterus. It is true that, with the possession of sufficient skill, we ought to be able to ascertain by abdominal palpation that a fœtus is above the normal size, but in practice there are so many obstacles, such as the thickness of the abdominal walls, and the amount of liquor amnii, that it is extremely difficult to do so with any certainty. As a rule, in these cases, the presence of a large fœtus is not suspected by the obstetrician, if the fœtal head has passed into the pelvic cavity. The forceps is applied on account of the delay in labour, and if the fœtus cannot be extracted in this manner, perforation is usually performed, and then, after extraction, the cause of the delay is recognised. It is difficult to say how an earlier diagnosis can be arrived at in such cases. An obstetrician of considerable experience might, it is true, be able to determine that he was dealing with a large fœtus by noticing that the distance between the fontanelles was greater than usual, but this is difficult and we must usually be satisfied with a post-partum diagnosis. When, however, the size of the fœtus is so great that the head cannot pass into the pelvic cavity, it is easier to arrive at a diagnosis. The first thing that is suggested by the detention of the head above the brim is a contracted pelvis, and if the history of the patient, and the measurement of the pelvis, shows that such is not the case, the next thing to be thought of is an unusually large head. Then, on passing the hand into the uterus and examining the head, we shall be able to detect the existence of such a condition. Uniform enlargement of the head, the result of the excessive size of the fœtus, can be distinguished from enlargement due to some pathological cause by the fact that the head preserves its normal configuration.

Treatment.—The treatment of cases of an unusually large fœtus calls for the exercise of considerable skill, if the fœtus is to be given the best prospect of life. If the fœtal head has passed the brim, delivery can usually be accomplished by the forceps. If the head is above the brim, the most suitable treatment to adopt depends upon the degree of disproportion present. If the disproportion is considerable, it may be that symphysiotomy offers the best chance, but, as this is a serious operation, the obstetrician naturally hesitates to adopt it, unless he is sure that delivery is not possible by any other means, and unless the surroundings are suitable for the performance of the operation. There is no doubt, however, that in many cases symphysiotomy offers the only chance of saving the fœtus. If the disproportion is not so considerable as to necessitate symphysiotomy, the performance of podalic version, and the extraction of the fœtus with the patient in Walcher's position may be successful. While, if the disproportion is but slight, and the non-descent of the head is due more to the weakness of the contractions than to the size of the head, extraction by the forceps may be possible. If the fœtus is dead and forceps extraction impossible, craniotomy must be performed.

It sometimes happens that, even after the head has been successfully delivered, the shoulders cannot be brought through. Such cases will be discussed in the next paragraph.

Excessive Size of the Shoulders.—Excessive size of the shoulders of the fœtus may be met with as part of a general fœtal enlargement, or as an enlargement confined to the shoulders alone. In both cases, the result is the same, the shoulders become impacted either at the pelvic brim or in the cavity, and the further advance of the fœtus is prevented.

Diagnosis.—The diagnosis of impaction of the shoulders is made when the head or the breech of the fœtus is delivered either naturally or artificially, and the shoulders do not follow in the

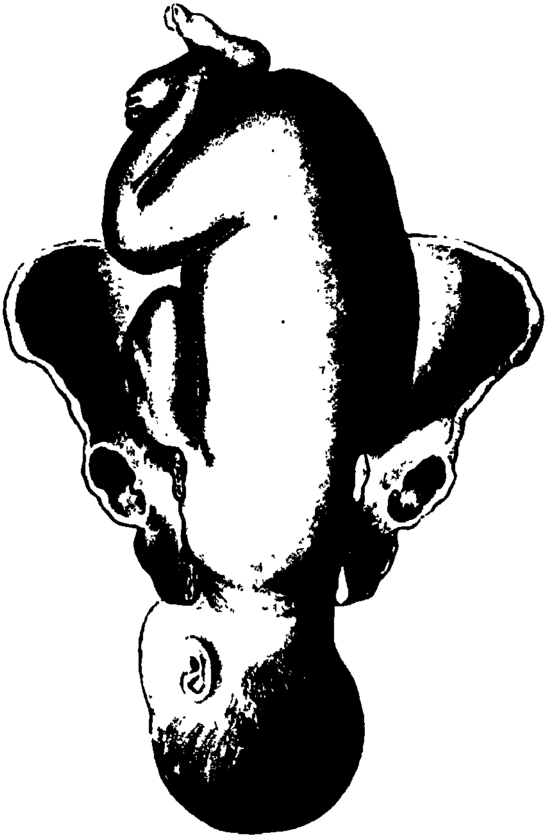

FIG. 359.—IMPACTED SHOULDERS.

The usual position of the shoulders when impacted in the pelvis.

usual manner. This impaction may be due to the excessive siz of the shoulders, or to the failure of normally sized shoulders t rotate.

Treatment.—If the head of the fœtus is expelled, but the shoulder do not follow it, the first step to be adopted, with the objec of expediting their delivery, consists in applying firm pressure t the fundus. If this is not sufficient, it is supplemented by traction upon the head. If this also fails, the fingers are passed into the vagina and hooked into the anterior axilla, which lies lower than the posterior. Downward traction is then made with these fingers, and, as soon as the shoulders have reached the pelvic floor, the axilla is guided forward beneath the arch of the pubis. If the shoulders will not descend, the fingers may be passed into the axilla which lies posteriorly, and traction made alternately upon the two. When the shoulders have been brought down as far as the pelvic outlet, it is possible to make traction on both simultaneously. If they do not respond to such forms of traction, the next step consists in bringing down one or both arms. This is done with the double object of diminishing the width of the shoulders by the thickness of each arm as it is brought down, and of giving an additional means of making traction on the body. If the arms can be brought down, it is probable that it will be always possible to extract the shoulders without any cutting operation; but, in cases in which the shoulders are firmly impacted in the pelvic cavity, it will not be possible to bring them down. In such cases, delivery without a cutting operation is usually impossible. If the arms cannot be brought down, or if, even after they have been brought down, delivery is still impossible, the next step consists in performing the operation of cleidotomy or division of the clavicles. This operation is said to effect a reduction in the length of the shoulder girdle of three to four centimetres, and to be not incompatible with the continued life of the fœtus. If the shoulders still will not descend, it is probable that there is some pathological enlargement of the thorax, and that the only course to adopt consists in performing embryotomy.

EXCESSIVE SIZE OF THE FŒTUS DUE TO DISEASE

HYDROCEPHALUS.—Hydrocephalus is the term applied to an abnormally large accumulation of cerebro-spinal fluid within the cranium. This fluid collects first in the ventricles, which it distends greatly. In some cases, it may remain confined there, but in others it bursts its way through the surrounding brain substance, and is found in the sub-arachnoid space, or between the arachnoid and the dura mater. The average amount of fluid that collects is about one to two litres (1¾ to 3½ pints), but as much as ten to twelve litres (17 to 20 pints) have been found in extreme cases (Ribemont-Dessaignes). The effect upon the brain of the accumulation of fluid is very marked. If the fluid remains in the ventricles, the brain substance is converted into a structure resembling the wall of a cyst, while, if the fluid finds its way through the brain to the meninges, the brain substance is compressed and flattened out against the cranial bones.

The effect upon the bones of the vault of the skull is also very marked. The bones are widely separated from one another, they are considerably thinner than is usual, and the sutures are enormously increased in size. The bones of the base of the skull and of the face are not affected by this change, and thus the characteristic hydrocephalic appearance of an enormous cranial vault overhanging a diminutive face is produced.

The causes of congenital hydrocephalus are very far from being determined. It sometimes occurs when the parents are syphilitic or alcoholic, and not uncommonly is found in association with other pathological conditions of the fœtus, such as spina bifida, hydramnios, hydrothorax, and club-foot. Ballantyne* speculates on its ætiology, but admits that little or nothing is known of it.

Frequency.—Hydrocephalus is a rare complication, and is said to occur once in every 1,000 to 2,000 labours.

Diagnosis.—The diagnosis of hydrocephalus, in which the cranial enlargement is considerable, can, as a rule, be made by abdominal palpation, by noting the size and consistency of the head. If the head presents, the diagnosis can be readily confirmed by vaginal examination after labour has commenced, by noting the separation of the cranial bones, the bulging of the sutures, and the increased size of the head, as shown by the fact that it does not descend into the pelvis. When there is a large accumulation of fluid, and considerable separation of the cranial bones, we may be unable to feel the latter by vaginal examination, and only find a large cystic tumour presenting inside the uterine orifice. It has not infrequently happened that, under such circumstances, a hydrocephalic head has been mistaken for an unruptured bag of membranes, and attempts made to rupture it with the finger-nail or stylette. Such a mistake may be avoided by noting the presence of hair and the unusual thickness of the supposed membranes. When the pelvic pole of the fœtus presents, we must rely on abdominal palpation altogether until the body of the fœtus has been born, and we are able to reach the head with the hand passed into the uterus.

Effect upon Labour.—The effect of hydrocephalus upon labour is similar to that of any other obstacle which prevents the descent of the head into the pelvis. The uterus makes violent efforts to expel the fœtus, and, failing to do so, a condition of secondary uterine inertia supervenes, or rupture of the uterus results. In very rare cases, the strength of the contractions may be sufficient to force the fluid through the thinned sutures outside the cranium. It then makes its way through the cellular tissue of the scalp downwards towards the neck. In this manner sufficient diminution in the size of the cranium may result to allow the latter to collapse, and so to enable delivery to occur.

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* 'Ante-natal Pathology and Hygiene,' vol. i., p. 389.

The greater the amount of fluid present, the more likely is the intracellular effusion of fluid to occur, as the thinner will be the interosseous membrane. The obstetrician must not, however, trust to the possibility of such an occurrence, as it is one of extreme rarity.

Treatment.—The treatment of hydrocephalus is obvious. The fluid must be allowed to escape, and then, if the uterine contractions do not rapidly expel the fœtus, it must be extracted. The ideal operation consists in tapping the head with a trochar and canula, as this affords some slight prospect of delivering the fœtus alive. If the necessary instruments are to hand, such a course may be adopted; but, even if the fœtus is delivered alive, it will rarely survive its birth for long, and, in the few cases in which it does so, will probably exhibit some mental deficiency. Consequently, the usual treatment to adopt consists in perforating the head and then extracting it with a cranioclast. Perforation is also adopted in the case of the after-coming hydrocephalic head, but, if the distension is very great, and if it is difficult to bring the head within reach of the perforator, the spinal canal may be opened, a catheter passed into it and pushed upwards into the cranium. By moving the catheter about, the accumulation of fluid will be tapped, and will escape through the catheter. The application of the cranioclast to the after-coming head is usually unnecessary, as the head can be delivered by Smellie's or Martin's method.

Prognosis.—The prognosis for the fœtus is almost absolutely bad in hydrocephalus. Even when it is born alive, it rarely survives more than a few hours. In a small proportion of cases, it may live for a few months, or possibly longer. The maternal prognosis depends upon the period of labour at which the condition is recognised. If it is detected in time, the treatment of the case is easy and the prognosis should not be more grave than in normal labour. If, however, the condition is not recognised, and the patient is allowed to remain undelivered, or if useless attempts at extraction are made with the forceps, the prognosis becomes more serious, as rupture of the uterus or serious lacerations of the maternal soft parts may result. It is well known that, in hydrocephalus, the maternal prognosis is better in the case of large accumulations of fluid than in the case of small accumulations, as the former are recognised at once, whilst the latter often escape recognition.

HYDROMENINGOCELE, AND HYDRENCEPHALOCELE OR ENCEPHALOCELE.—A hydromeningocele is the term applied to a cystic tumour on the outside of the cranium formed by the extrusion through a cleft in the cranial bones of a portion of the meninges filled with fluid. It is the result of the association of a subarachnoid accumulation of fluid and a cleft in the cranial bones. Hydrencephalocele or encephalocele is a rarer condition, in which a tumour containing fluid and brain substance forms on the outside of the cranium. It is the result of the association of an accumulation of fluid in the ventricles and a cleft in the cranial bones. The tumour is usually of ovoid form and is connected with the cranium by a pedicle of varying size. There may or may not be free communication between the tumour and the cranial cavity. Such tumours are most commonly found in the occipital region, and also in the frontal. They may, however, occur at any point in the cranial vault. Winckel classifies them,

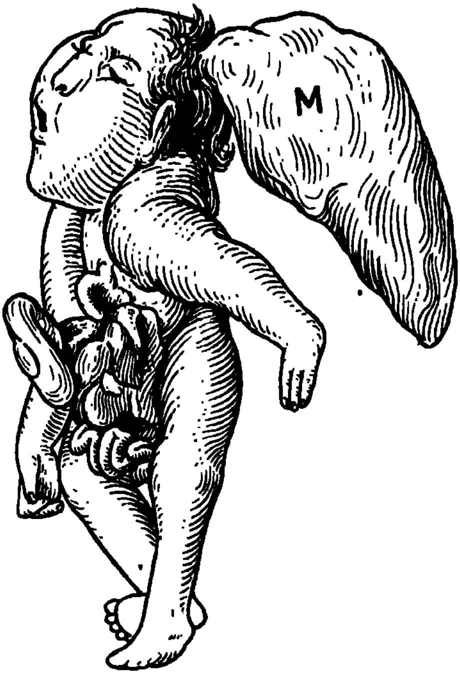

FIG. 360.—A FŒTUS WITH HYDROMENINGOCELE AND CONGENITAL ABSENCE OF ABDOMINAL WALL.

M, Hydromeningocele (From a specimen in the School of Physic, Trinity College, Dublin.)

according to their situation, as anterior, posterior, lateral, superior, or inferior.

Treatment.—Such tumours, if small, do not, as a rule, give rise to any difficulty during delivery. If they are of large size, they must be punctured and the fluid allowed to escape. The fœtu can then be delivered by the forceps or delivery left to the natura efforts.

General Fœtal Œdema, Hydrothorax, Ascites.—General fœtal œdema sometimes gives rise to difficult labour, owing to the increase which it causes in the size of the fœtus. Sometimes, this increase is uniform and is due to a general dropsical condition of the fœtal skin, while, at other times, it is due to an accompanying accumulation of fluid in the thoracic or peritoneal cavity. The weight and dimensions of the fœtus are always increased. The causes of fœtal dropsy, like the causes of hydrocephalus, are as yet undetermined. Ballantyne* suggests that it may arise in the later months of pregnancy from maternal conditions which increase the blood-pressure in the placenta, thus leading to increased pressure in the fœtal vessels and transudation of serum in the fœtal body. He also suggests that structural alterations may occur in the fœtal heart, kidneys, liver, or blood, and directly produce increased blood-pressure as in the adult.

Hydrothorax—a collection of fluid in the thoracic cavity—may occur in association with general œdema, or as a distinct condition. It may cause very considerable enlargement of the chest. Its pathology is obscure.

Ascites is a more common condition, and may occur in association with, or distinct from, general œdema. It may lead to an enormous increase in the size of the abdomen. The average amount of fluid is from two to four litres (3½ to 7 pints), but as much as twelve to fifteen litres have been found. The ætiology of fœtal ascites is not clearly established. It occurs in fœtal syphilis, when it is probably due to changes in the liver. It may also occur as a result of pressure on the portal vein—as in a case recorded by Herman.† According to Ballantyne,‡ it is most frequently the result of peritonitis. The cause of peritonitis in such cases is obscure, but in one case it was found to be an escape of urine into the peritoneal cavity.

Effect upon Labour.—The effect of these different conditions upon labour is to cause a degree of obstruction which varies in proportion to the increase in size of the fœtus. In some cases, labour may be merely delayed, but, in others, the further advance of the fœtus becomes impossible, and secondary uterine inertia or rupture of the uterus results.

Diagnosis.—The diagnosis of general fœtal œdema can only be made by vaginal examination or by passing the hand into the uterus and examining the fœtus. If the œdema affects the scalp, the condition ought to be recognised on vaginal examination. The diagnosis of hydrothorax and ascites can only be made in the latter manner, save in cases where there is an enormous accumulation of fluid, when a diagnosis may be made by abdominal palpation. As a rule, however, the existence of such conditions will not be recognised until after the birth of the presenting part, when the size of the thorax or abdomen will delay or prevent the further descent of the fœtus.

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* *Op. cit.*, p. 296.

† *Med. Times and Gazette*, pt. ii, 731, 1881

‡ *Op. cit.*, p. 361.

Treatment.—If the expulsion of the fœtus is prevented by a condition of general œdema, the first step consists in evacuating all cavities in which fluid may be contained. Accordingly, if the head is increased in size in consequence of hydrocephalus, it must be perforated, and the thorax and peritoneal cavity in turn similarly treated, as they are brought within reach. If the increase in size of the fœtus is due to a general waterlogging of the tissues, craniotomy followed by embryotomy may have to be performed. In hydrothorax or ascites, the affected cavity should be tapped with a trochar and canula and the fluid evacuated, and embryotomy is only necessary when the accumulation of fluid is associated with a tumour or enlarged viscus.

Prognosis.—The maternal prognosis is similar to that of hydrocephalus, and depends upon the early recognition of the condition. The fœtal prognosis is absolutely bad, although a case has been recorded in which the infant survived after the abdomen had been tapped and a quantity of fluid evacuated.

ABNORMALITIES OF THE URINARY ORGANS.—Hydronephrosis is sometimes met with in consequence of obliteration of the ureter, and the distended kidney may reach a large size. Cystic degeneration of one or both kidneys is also met with, in which the kidney becomes greatly enlarged and converted into a mass of small cysts. This condition is said to be due to a sclerosis of the uriniferous tubules, especially in the neighbourhood of the papillæ. More recent researches, however, tend to show, according to Ballantyne, that it is of the nature of an adenomatous degeneration.

Retention of urine in the bladder may also result in the formation of a large abdominal tumour. As much as two and a half litres of fluid have been found (Fabris*), while, in the case recorded by Schwyzer,† the fluid was said to amount to 6½ litres. The cause of the retention is found in obliteration or kinking of the urethra. It is obvious, however, that in the case of a large accumulation there must be also some pathological condition present capable of causing an abnormal increase in the amount of urine secreted by the kidneys.

Cystic conditions of the kidney or bladder are usually diagnosed before delivery as ascites, and are treated accordingly. It is only on subsequently opening the abdomen of the fœtus that the true cause of the enlargement is discovered.

SPINA BIFIDA.—Spina bifida is the term applied to a cystic tumour found on the back, usually over the lumbo-sacral or dorsal region of the spinal column, and which is formed by the protrusion of the spinal meninges through a fissure in the spinal column, the result of imperfect development. It contains a varying amount of cerebro-spinal fluid, and may reach the size of a fœtal head.

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* *Ann. di ostet.*, xvii., p. 329, 1895.

† *Arch. f. Gynæk.*, xliii., 333, 1893.

Spina bifida rarely reaches such a size as to offer an obstacle to delivery. If it does, it will retard or prevent the descent of the back. Its existence will then be ascertained by passing the hand upwards along the back or limbs of the fœtus, as the case may be. In such cases, it must be punctured and the fluid allowed to escape.

SACRO-COCCYGEAL TUMOURS.—Solid, semi-solid, or cystic tumours are sometimes met with attached to the sacro-coccygeal region of the fœtus. These tumours are of three different classes. One class is due to the inclusion of portions of a second fœtus—a teratoma. A second class is cystic and communicates with the spinal canal, and so is akin to a spina bifida. A third class is cystic or solid in character, and may resemble in structure many of the simple and malignant tumours of adult life. All classes of tumour vary greatly in size. If they are so large as to obstruct delivery, they must be removed, but, as a rule, they are soft and pliable, and do not give rise to any difficulty during delivery.

CYSTIC AND SOLID TUMOURS OF THE NECK.—Different forms of cystic enlargement are occasionally met with in the region of the neck. Cystic hygroma is the term applied to a tumour which originates in degenerated lymphatic vessels. It may be situated in front of or on the nape of the neck, and sometimes reaches the size of a fœtal head. Cystic enlargement of the thyroid gland also occurs, and may attain a large size. Congenital enlargements of the thyroid are, however, as a rule solid (Winckel). They are sometimes hyperplastic, and sometimes fibrous or cartilaginous. They may attain a large size.

These conditions, as a rule, do not offer an obstruction to delivery, as they are soft and easily moulded. If they prevent the passage of the head, they must be tapped or removed piecemeal, according as they are cystic or solid.

TUMOURS OF THE LIVER AND SPLEEN.—Such tumours occasionally occur of sufficient size to obstruct delivery. In such cases, they must be removed by embryotomy.

MONSTERS, PROPERLY SO CALLED

Under this heading, we propose to discuss such of the recognised forms of atypical development as affect the course of labour. We do not propose to enter into a description of all the various forms of malformations, as to do so would be out of place in a work on obstetrics. It will, however, be necessary to give a brief description of them, and, in this, we shall follow the classification adopted by Geoffroy Saint-Hilaire.* In this classification, for the sake of convenience of description, the terms 'class,' 'order,' 'family,' 'genus,' 'species,' and 'variety,' are used as if such a terminology was permissible.

Monsters are divided into two great classes—single monsters and double monsters.

Single Monsters.

Single monsters are those which possess the elements—complete or incomplete—of a single individual. This class is divided into three orders :—

(A) **Omphalosites** (ὀμφαλός, the navel; σῖτος, food), in which the most essential organs are wanting, and which consequently only develop passively by a connection through the umbilical cord with the circulatory apparatus of a twin.

This order is divided into three families as follows :—

(1) *Paracephalians* (παρά, beside; κεφαλή, the head), in which there is a rudimentary head formation, general asymmetry, and absence of limbs and various organs.

(2) *Acephalians* (ἀ, negative; κεφαλή), in which there is complete absence of the head (*v.* Fig. 361).

(3) *Anidians* (ἀ, negative; εἶδος, form), in which the organism consists of a membranaceous sac enclosing various soft formations and bloodvessel ramifications.

(B) **Autosites** (αὐτός, self; σῖτος), in which the essential organs are sufficiently developed to allow independent progressive development.

(C) **Parasites** (παράσιτος, a parasite), which are mere shapeless masses, lacking even an umbilical cord, and adherent to the maternal sexual organ from which they receive their nourishment.

Only one of these three orders need be considered here, *i.e.*, autosites.

Autosites.—This order is divided into four families, according as the characteristic malformation is of the limbs, trunk, cranium, or face. These are as follows :—

(1) *Teratomelians* (τέρας, a monster; μέλος, a limb), in which the limbs are malformed. They are again divided into two genera :—

- (*a*) Ectromelians (ἔκτρωμα, an abortion; μέλος), in which the whole or part of one or more limbs is wanting.
- (*b*) Symelians (σύν, together; μέλος), in which one or both pairs of limbs are fused together.

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* 'Histoire générale et particulière des anomalies de l'organisme,' 1832-1836.

(2) *Teratosomians* (τέρας; σῶμα, the body), in which there is an arrest of development of the anterior abdominal wall

(3) *Terato-encephalians* (τέρας; ἐγκέφαλος, the brain), in which there is incomplete development or absence of the walls of the cranial cavity or the brain. They are again divided into three genera:—

(*a*) Exencephalians (ἐξ, out; ἐγκέφαλος), in which there is an incomplete development of the vault of the cranium.

(*b*) Pseudencephalians (ψευδής, false; ἐγκέφαλος), in which, in addition to an imperfect development of the vault of the cranium, there is also an incomplete development of the brain, which is only represented by some vascular tissue.

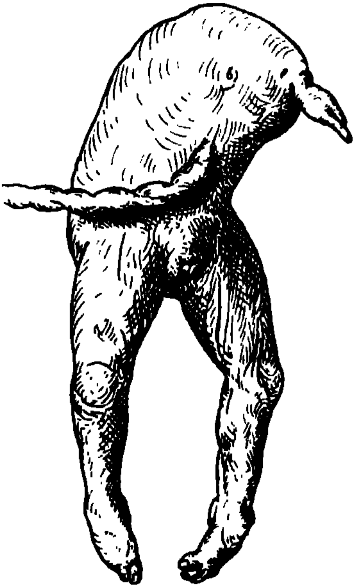

FIG 361.—AN ACEPHALIAN OMPHALOSITE.
(From a specimen in the School of Physic, Trinity College, Dublin.)

(*c*) Anencephalians (ἀ; ἐγκέφαλος), in which there is complete absence of both cranial vault and brain.

(4) *Teratocephalians* (τέρας; κεφαλή), in which there is arrested development or non-formation of the median portions of the face, the lateral portion coalescing more or less completely in the middle line. They are again divided into two genera:—

(*a*) Cyclocephalians (κύκλος, a circle; κεφαλή), in which the median portions of the upper part of the face are wanting.

(*b*) Otocephalians (οὖς, an ear; κεφαλή), in which the median portions of the lower parts of the face are wanting.

All the preceding genera are subdivided into species, into which it is quite unnecessary to enter in a work on obstetrics.

Single monsters do not possess at all the same obstetrical importance that double monsters possess, inasmuch as they seldom interfere to a serious extent with the mechanism of labour. Parasites, or as they are often termed, acardiac monsters, are occasionally met with in cases in which twins have developed from a single ovum. If the circulation of one twin is considerably stronger than that of the other, and if there is a free anastomosis between their respective umbilical vessels at the placenta, the stronger heart tends to drive its blood not only into its own portion of the placenta, but also into the portion belonging to the weaker heart. This hampers the weaker heart, and makes it become progressively weaker and finally cease. The stronger heart then drives its blood not alone through its own circulatory system, but also through that of the dead twin, and so enables a feeble form of growth to continue. As the single heart is unable to effectively discharge the duty of two, it follows that only the parts of the dead fœtus near the umbilicus receive sufficient blood to develop at all fully, and, consequently, a mass results in which the limbs and head may be rudimentary or completely wanting (*v.* Fig. 361). In this way, the various families which we have enumerated above are obtained.

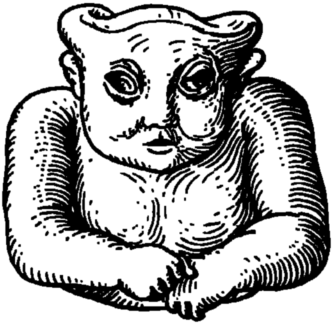

FIG. 362.—AN ANENCEPHALIC MONSTER.
Family: Terato-encephalian. *Genus*: Exencephalian. (From a specimen in the School of Physic, Trinity College, Dublin.)

The commonest family of single autosite, that is met with in practice, is perhaps the terato-encephalian, in which the vault of the cranium, and perhaps a portion of the brain, is incompletely developed or absent. These monsters are usually termed anencephalic monsters, though correctly that term should be only applied to a single genus. The diagnosis of the presentation by vaginal examination is often extremely puzzling in these cases. As a rule, the neck of the monster is very short, and consequently neither flexion nor extension occurs. The head is usually small, and so is able to pass through the pelvis with what ought to be the vertex, or perhaps the brow, presenting. This region is, however, represented by a gap in the cranial vault filled in by a membrane, and possessing very irregular edges (v. Figs. 362, 363). If the condition has been once felt *per vaginam* it will be recognised in subsequent cases, but the first time it is met with it is puzzling.

DOUBLE MONSTERS.

Double monsters are of considerably more importance from an obstetrical point of view than are single monsters, as they cause considerable difficulty during delivery. They are divided into two main orders :—

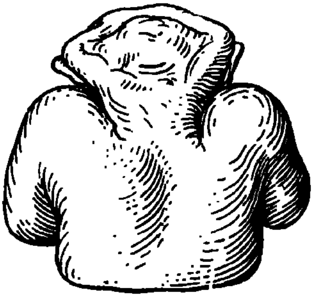

FIG. 362.—BACK VIEW OF ANENCEPHALIC MONSTER SHOWN IN FIG. 363

(A) Double Autosites, composed of two almost equally developed individuals.

(B) Double Parasites, composed of the union of a single autosite with a single omphalosite or parasite.

(A) **Double Autosites.**—Double autosites are divided into three families :—

(1) *Teratopagians* (*τέρας*; *παγή*, anything that holds fast, *hence* a union), in which two complete individuals are united to one another by a single region of the body. This family is divided into two genera :—

(*a*) **Eusomphalians (*εὖ*, well; *ὀμφαλός*), in which each individual has an umbilicus and an umbilical cord.**

(*b*) **Monomphalians (*μόνος*, single; *ὀμφαλός*), in which there is a common umbilicus and umbilical cord.**

(2) *Teradelphians* (τέρας; ἀδελφός, a brother,) in which the two individuals are separate below the umbilicus, but are united to a varying degree between the head and the umbilicus. This family is divided into two genera:—

(*a*) Sycephalians (σύν; κεφαλή), in which there is close fusion of the heads and of the bodies from the umbilicus upwards.

(*b*) Monocephalians (μόνος; κεφαλή), in which there is a single head with no external trace of duplicity, and two more or less completely fused trunks.

(3) *Teratodymes* (τέρας; δίδυμος, double), in which the cephalic extremities are independent, but the pelvic extremities are completely united, thus making them the reverse of teradelphians. They are divided into two genera:—

(*a*) Sysomians (σύν; σῶμα), in which there are two recognisable but more or less fused trunks with distinct heads rising from a common pelvis and lower limbs.

(*b*) Monosomians (μόνος; σῶμα), in which there is a single body with no external trace of duplicity, and two more or less completely fused heads.

(B) **Double Parasites.**—Double parasites are divided into five families, as follows:—

(1) *Heterotypians* (ἕτερος, other; τύπος, a type), in which a parasite is connected with an autosite in a similar manner to that in which any of the three families of double autosites are connected with one another.

(2) *Heteralians* (ἕτερος; *alius*, another), in which the parasite consists of a single part of another fœtus and is engrafted on any part of the autosite. Thus, an accessory head may be grafted on to the head of an autosite.

(3) *Polygnathians* (πολύς, many; γνάθος, a jaw), in which the parasite is formed of the maxillæ or other portion of the head and is grafted on to the maxillæ of the autosite.

(4) *Polymelians* (πολύς; μέλος, a limb), in which the parasite consists of one or more limbs grafted on the autosite.

(5) *Endocymians* (ἔνδον, within; κῦμα, a fœtus), in which the parasite is enclosed within the autosite, usually in the abdominal cavity.

In the foregoing list we have omitted all reference to species, as to include them would mean unduly extending the classification. It must be remembered that triple monsters may occur, and that they can be classified in a similar manner to double monsters.

Double monsters are of considerably more importance from an obstetrical point of view than are single monsters, as, unless they are very small, they will always give rise to difficulty during delivery. In discussing them from this point of view, a more general classification than that which we have given above must be adopted, and so, for practical purposes, we shall divide them into two main classes:—

(A) Those in which one end of the body is double. This class may be further divided into two groups:—

(1) Those in which the cephalic end is double, a type of which is seen in some of the species of the Symosian genus of the family Teratodyme, and notably in the species known as Psodyme (ψόα, the loin; διδυμος); (*v.* Fig. 364).

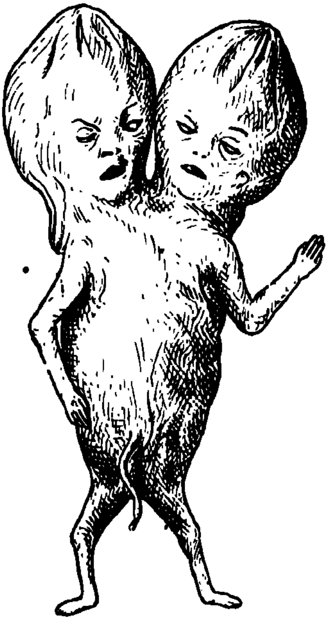

Fig. 364.—A Teratodyme.

Family: Teratodyme. *Genus*: Symosian. *Species*: Psodyme. (From a specimen in the School of Physic, Trinity College, Dublin.)

(2) Those in which the podalic end is double, a type of which is seen in some of the species of the Teradelphian family, Sycephalian genus of the family, especially in that species known as Iniopes (ἰνίον, the occiput; ὤψ, the eye); (*v.* Fig. 365).

(B) Those in which there are two outwardly distinct infants, which are more or less closely connected. This class may be divided into three groups, all of which are met with as species of the Teratopagian family. These groups are as follows:—

(1) Those in which the infants are united at the level of the head—cephalopagous (κεφαλή; παγή) monsters.
(2) Those in which the infants are united at the level of the thorax—thoracopagous (θώραξ, the chest; παγή) monsters, or at the level of the xiphoid cartilage—xiphopagous (ξίφος, a sword; παγή) monsters (*v.* Fig. 366).
(3) Those in which the infants are united at the level of the pelvis—ischiopagous (ἰσχίον, the hip; παγή) monsters (*v.* Fig. 367).

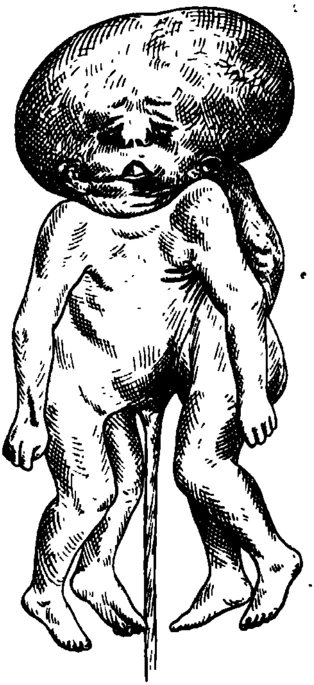

FIG. 365.—A TERADELPHIAN.
Family: Teradelphian. *Genus*: Sycephalian. *Species*: Iniopes. (From a specimen.)

Diagnosis.—The diagnosis of the presence of a double monster is by no means easy, and is rarely made until either spontaneous expulsion takes place, or an obstruction to delivery necessitates the passage of the hand into the uterus. A suspicion of the condition of affairs present may be obtained by abdominal palpation, but it is obvious that it is always extremely difficult to distinguish between a double monster and an ordinary twin pregnancy, and that sometimes—as in cases where there are two outwardly distinct infants—it is impossible to do so. In cases in which only one extremity is doubled, a diagnosis may be made by finding on careful palpatión three 'large parts'—*i.e.*, heads or breeches, and by hearing on auscultation only one fœtal heart.

Treatment.—If a diagnosis of double monster is made, there is a general rule of treatment, namely, to pass the hand into the uterus, endeavour to ascertain the nature of the monstrosity, and bring down all the feet. Then, if the natural efforts are not sufficient to bring about delivery, apply traction.

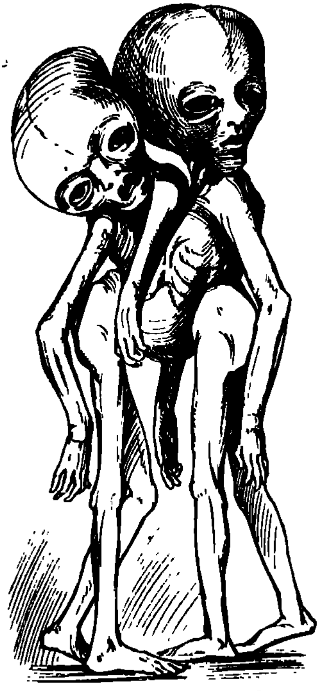

FIG. 366.—A XIPHOPAGOUS MONSTER

Family : Teratopagian. *Species* : Eusomphalian. (From a specimen in the School of Physic, Trinity College, Dublin.)

Spiegelberg* advises that, during the extraction, both trunks should be brought into the oblique diameter of the pelvis, with the object of preventing the hitching of the heads above the promontory or anterior pelvic wall. It may then be possible to induce the posterior head to enter the pelvis first, and to pass into the sacral concavity, if the trunks are carried well forward over the abdomen of the mother, as this causes the anterior head to move upwards and backwards over the brim of the pelvis, and so retards its descent. If version cannot be performed, or if, after its performance, extraction is impossible, embryotomy must be performed with the object of separating the two infants or of removing the doubled extremity.

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* *Op. cit.*, vol. ii., p. 175.

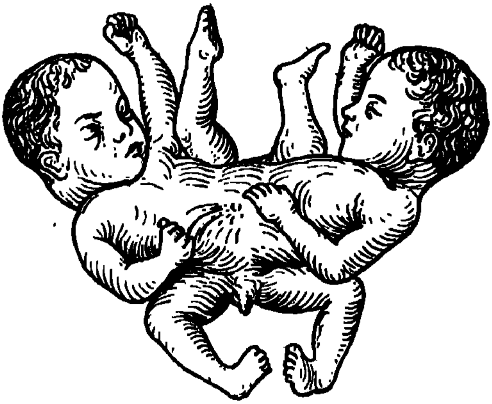

FIG. 367.—AN ISCHIOPAGOUS MONSTER.

Family : Teratopagian. *Genus* : Monomphalian. (From a specimen in the Royal College of Surgeons, Dublin.)

CHAPTER IX

POST-PARTUM HÆMORRHAGE

Primary Post-partum Hæmorrhage — Traumatic Hæmorrhage: External, Internal — Atonic Hæmorrhage — Concealed Atonic Hæmorrhage. Secondary Post-partum Hæmorrhage. — Post-hæmorrhagic Collapse — Infusion of Saline Solution. — Retention of the Placenta.

PRIMARY POST-PARTUM HÆMORRHAGE

PRIMARY post-partum hæmorrhage is the term applied to hæmorrhage occurring at any time within six hours after the birth of the child. It is one of the commonest accidents met with in midwifery. There are two distinct varieties:—

I. Traumatic hæmorrhage.
II. Atonic hæmorrhage.

A TRAUMATIC HÆMORRHAGE.

The term traumatic hæmorrhage is applied to hæmorrhage due to laceration of any part of the genital tract, the result of direct or indirect violence Bleeding due to rupture of the uterus is not, however, included under this head, as, in the majority of cases of rupture, hæmorrhage is only one of several symptoms, and, consequently, is better dealt with under the head of rupture of the uterus.

Varieties.—Two varieties of traumatic hæmorrhage are met with:—External traumatic hæmorrhage; and internal traumatic hæmorrhage.

EXTERNAL TRAUMATIC HÆMORRHAGE. — External traumatic hæmorrhage, in which the blood escapes externally, is very much the more common variety.

Ætiology.—External hæmorrhage may result from lacerations occurring about the clitoris, perinæum, or cervix during the expulsion of the child. Perinæal lacerations very rarely bleed to an extent sufficient to justify the name hæmorrhage.

Symptoms.—The symptom of the case is a varying amount of hæmorrhage, which is not affected by the contractions of the uterus.

Diagnosis.—External traumatic hæmorrhage has to be distinguished from atonic hæmorrhage, that is, from hæmorrhage due to failure of the uterus to contract. In practice we find that, as a rule, we commence to treat all cases as if they were atonic hæmorrhage, and that it is owing to various points which are noticed during this treatment that we make the diagnosis of traumatic hæmorrhage. 1 The first of these points is that the bleeding is found to be unaffected by the contractions of the uterus; the patient bleeding as rapidly when the uterus is contracted as when it is lax. 2 The second is that while we are douching out the uterus or vagina with a double-channel catheter we notice that though blood is flowing over the vulva, the fluid which is returning through the catheter is colourless. 3 If the hæmorrhage is coming from a laceration of the clitoris or perinæum, this point is noticed when the nozzle of the catheter is in the vagina; if from the vagina or cervix, when the nozzle is in the uterus. As soon as we have in this manner roughly localised the site of the hæmorrhage, the exact bleeding spot can be found by careful examination.

Treatment.—1 If the hæmorrhage is found to come from a laceration of the clitoris, the easiest and most effective method of checking it is to pass a silk suture with a small curved needle deeply beneath each end of the laceration. These sutures, which may if necessary be passed quite down to the bone, are then tied, and, as a rule, the hæmorrhage immediately ceases. If the tear is of considerable extent, a third suture may be passed between the others. These sutures are removed on the eighth day. Occasionally, bleeding follows their removal, but, if so, it can always be checked by applying a firm compress for a few hours.

2 If the hæmorrhage is coming from the perinæum, it will be checked by the ordinary sutures, which are inserted to bring together the lacerated perinæal body. 3 Hæmorrhage coming from a cervical laceration is the most troublesome to check, on account of the difficulty of exposing and suturing the laceration. The method of doing so will be subsequently described.

Prognosis.—The prognosis of external traumatic hæmorrhage is always good, unless the case is either neglected or improperly treated. A cervical laceration may, however, be extremely serious in cases of low insertion of the placenta, owing to its proximity to the uterine sinuses.

2 INTERNAL TRAUMATIC HÆMORRHAGE.—Internal traumatic hæmorrhage is the term applied to traumatic hæmorrhage in which the blood instead of escaping externally flows into the peri-vaginal or peri-vulvar tissues. If this occurs, a hæmatoma forms of varying size, and to this condition has been given the name of ***hæmatoma vaginæ et vulvæ.***

Frequency.—Internal traumatic hæmorrhage, sufficient in amount to require treatment, is a very rare occurrence. Statistics of its relative frequency are difficult to obtain. Winckel estimates its frequency at 1 in 1,000, Hugenberger at 11 in 14,000. At the Rotunda Hospital, there were 10 cases in 20,000 deliveries.

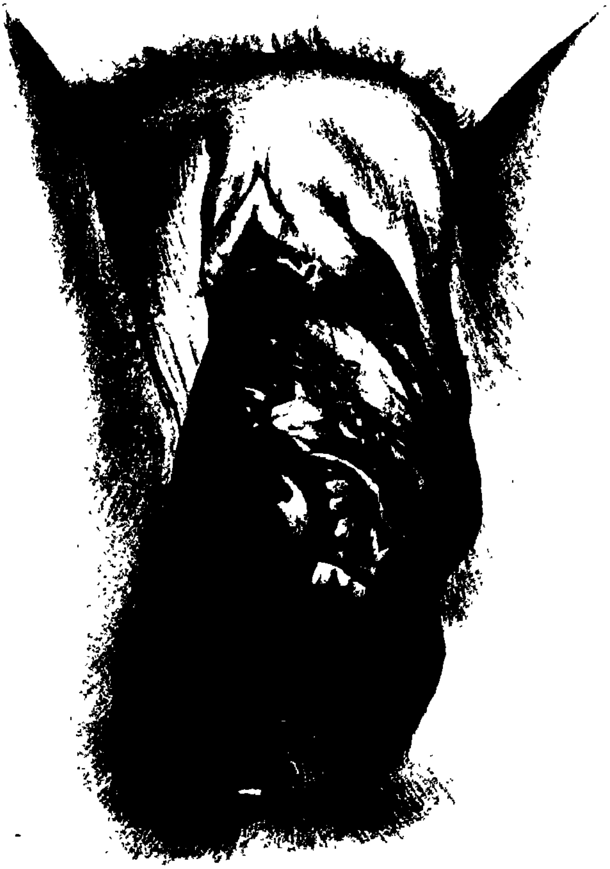

FIG. 368.—HÆMATOMA OF THE VULVA (Bumm)

Ætiology.—The direct cause of the condition is the rupture of a vein in the tissue beneath the lowest part of the vaginal wall, or, more rarely, beneath the vulvar mucous membrane (Winckel). The cause of the rupture is sometimes to be found in great stretching of the vaginal walls, especially when very rapidly accomplished, in the existence of vulvo-vaginal varices, or as the result of subsequent sloughing of the coats of a bloodvessel, the result of long-continued pressure. In the majority of cases of this kind, no assignable cause can be found, and the rupture of the vessel may have been due to a pre-existing abnormal thinness of its coats, or to the gliding of the vaginal wall over the deeper structures as the vagina is drawn upwards during labour, a gliding which may be associated with laceration of a vessel (Perret). A strong predisposing element to rupture, and one which is present in all labours, is obstruction to the venous return during the descent of the head, as this tends to produce thinning of the walls of the veins by overdistension.

Pathological Anatomy.—These hæmorrhages may occur either below or above the pelvic diaphragm, and, consequently, can be divided into infra-fascial and supra-fascial. Infra-fascial hæmatomata usually form at one side of the lower portion of the vaginal canal. If they form externally, they are most frequently situated in the labia majora, more rarely in the labia minora, or in the remains of the hymen or perinæum. A well-defined tumour usually results, varying in size from that of a hen's egg to that of a fœtal head. In some cases, the hæmorrhage may extend in all directions, surround the whole vulva and vagina, and extend downwards upon the thighs. Sometimes, as the result of perforation of the pelvic fascia from sloughing, such hæmorrhage may extend upwards, as in supra-fascial hæmatomata. Primary supra-fascial hæmatomata are very rare. If a vessel ruptures in this region, blood may collect round the upper part of the vagina, and then extend upwards in all directions beneath the peritoneum, reaching the kidneys behind, the level of the umbilicus in front, and the iliac crests laterally.

Symptoms.—A hæmatoma may commence to form during delivery, but, although the vessel may be torn prior to the expulsion of the child, the pressure of the head will usually prevent the escape of blood until after that event. Whether the child has been expelled or not, the first symptom of the condition is intense pain, associated with swelling in the neighbourhood of the ruptured vessel. In a short time, a small tumour forms, elastic to the touch and of a blue colour, and gradually increases in size. If the hæmorrhage continues and the case is not treated, this tumour may rupture and the bleeding become external. At the same time, the patient becomes collapsed and anæmic in proportion to the amount of blood lost.

Terminations.—Internal traumatic hæmorrhage, if allowed to remain untreated, may terminate in one of the following ways:—

(1) The tumour may rupture, and free external hæmorrhage result, which may or may not prove fatal.

(2) The hæmorrhage may extend interstitially — upwards towards the abdomen, or downwards towards the perinæum—

according as the ruptured vessel is above or below the pelvic fascia. The patient may thus bleed to death into her subcutaneous tissue.

(3) The tumour if small may be absorbed aseptically.

(4) Suppuration or decomposition of the contents of the tumour may occur.

Treatment.—If the condition is recognised before the birth of the child the latter should be delivered immediately. a If the amount of effused blood is small, the forceps can be applied in the ordinary manner. If, however, the size of the tumour is so great as to obstruct delivery, its walls must be incised, its contents turned out, a piece of iodoform gauze placed over the opening, and the child delivered as quickly as possible. If the tumour has not been incised, and if it increases slowly in size after delivery, the effects of firm pressure upon it may be tried. If this fails, or if the increase in size has been very rapid, it will be necessary to incise its walls and turn out the contents. In every case in which incision is practised, and the cavity is of large size, the latter should be douched out and then firmly plugged with iodoform gauze. This plugging must be changed every day until the cavity is obliterated. If the cavity is small, deep sutures passed beneath it, so as to bring its walls together when they are tied, will be found to be more satisfactory than the plug.

If the tumour is of small size it may be left to absorb. d If suppuration occurs, the abscess must be opened at the spot at which it points, the pus evacuated, and the cavity plugged with iodoform gauze.

Prognosis.—The prognosis depends upon the treatment adopted and on the situation of the hæmorrhage. Supra-fascial bleeding is very much more dangerous than is infra-fascial, on account of the difficulty of checking it. In either case, the patient may die from the continuance of hæmorrhage or from sepsis. In the usual form of hæmatoma neither will occur, if the case is properly treated.

ATONIC HÆMORRHAGE.

Atonic post-partum hæmorrhage is the term applied to hæmorrhage due to the failure of the uterus to contract. Loss of blood occurs to a very slight extent in almost all cases of labour, as it is impossible for the placenta to be detached and expelled without such an occurrence. It is only when the amount lost becomes excessive that the term post-partum hæmorrhage can be applied to it. The average amount of blood lost, taking clots and fluid blood together, is four ounces before the placenta is delivered, and six ounces with the placenta and membranes (Dakin). According to Winckel, as soon as the patient has lost from 400 to 500 grammes (fourteen to seventeen ounces) of blood, active treatment must be commenced with the object of preventing further loss.

Frequency.—The frequency of atonic post-partum hæmorrhage is difficult to determine, as the term post-partum hæmorrhage has been used loosely in the past, and different observers hold different opinions as to the amount of hæmorrhage to which the term can be applied. In the Rotunda Hospital, amongst 20,000 patients, there were 319 cases of hæmorrhage which required some form of treatment more radical than the massage of the fundus and the administration of ergot, that is, one case in 62·69. Amongst these, a few cases of traumatic hæmorrhage are included.

Ætiology.—Before starting to discuss the causes of atonic post-partum hæmorrhage it is well to understand the factors which normally prevent its occurrence. The hæmorrhage, which occurs during the detachment and expulsion of the placenta, is normally checked by the united action of three factors:—

(1) The Contractions of the Muscular Coat of the Uterus.—The contractions of the muscular coat of the uterus bring about a temporary cessation of hæmorrhage during their occurrence. Each fibre of the uterus diminishes in length, and as a result the whole organ becomes almost as firm and hard as a billiard ball, and its supplying arteries are compressed. As soon as the contraction passes off, and it only lasts a very short time, the uterine fibres lengthen, the compression of the vessels ceases, and hæmorrhage would recommence if another factor quite distinct from, but in a manner dependent on the contraction, did not also occur. This factor, which is the most potent agent in causing the permanent cessation of the hæmorrhage, is the retraction of the uterine muscle fibres.

(2) The Retraction of the Uterine Muscle Fibres.—Retraction, *i.e.*, the permanent and progressive shortening that occurs in the uterine muscle fibres in consequence of contraction, brings about a reduction in the size of the uterus, sufficient to cause a permanent kinking and compression of the placental vessels. It is, therefore, the process to which the final and permanent checking of hæmorrhage is due.

(3) The Clotting which occurs in the Mouths of the Vessels.—The clotting which occurs in the mouths of the vessels is so unimportant a factor in the checking of hæmorrhage that it may be almost neglected. It may be the direct cause of the cessation of hæmorrhage in some small vessels, but it is probably more correct to consider it as the result rather than as a cause of the cessation of hæmorrhage.

The foregoing are the normal agencies by which post-partum hæmorrhage is prevented, and, knowing them, we are now in a better position to understand what are the conditions which will favour the occurrence of hæmorrhage. Speaking generally, these conditions may be said to include anything which tends to prevent the due retraction of the uterine muscle fibres, either directly, as a retained adherent placenta, or indirectly, by preventing contraction from taking place, as degeneration of the fibres from some pathological condition.

The following are the principal causes of post-partum hæmorrhage:—

(1) Retained Placental Fragments, Membranes, or Blood-Clots. Such a condition is generally due to bad management of the third stage. Fragments of placenta and membranes may, however, also be retained owing to their too firm adhesion to the uterine wall, the result of a former endometritis.

(2) Uterine Inertia.—This may in turn be due to:—Previous overdistension of the uterus, as in hydramnios and twins; metritis; prolonged labour; weak muscular development of the uterus; faulty shape, or maldevelopment of the uterus; tumours.

(3) Precipitate Labour. — During a precipitate labour, the uterus has not had time to undergo the normal amount of retraction, and consequently is not ready—so to speak—for the third stage.

(4) Placenta Prævia.—In this condition, the hæmorrhage results from the non-obliteration of the supplying vessels of that portion of the placenta which is attached to the non-contractile lower uterine segment.

(5) Tumours of the Uterus.—These cause uterine inertia, and prevent the uniform retraction of the fibres.

(6) Any Condition which weakens the Patient.—Such as previous hæmorrhages, and any form of wasting disease.

Diagnosis.—The diagnosis of atonic hæmorrhage is made on finding hæmorrhage coming from the interior of a non-contracted or badly contracted uterus.

Treatment.—The treatment of post-partum hæmorrhage is both prophylactic and curative. Prophylactic treatment consists in the proper management of the third stage. If this third stage is correctly managed, the frequency of post-partum hæmorrhage is reduced to a minimum. It has been said that the number of cases of this form of hæmorrhage which occur in a doctor's practice are in proportion to the want of skill with which he manages this critical period.

The curative treatment of post-partum hæmorrhage is most satisfactory, if it is intelligently carried out. It is essential to have a definite plan of action laid down which we know so thoroughly that we shall follow it mechanically, and which is so graduated as to commence with the mildest measures, and then pass on—if they fail—to others which will be more radical. The following is such a plan in the order that should be adopted, and presupposing that the failure of each measure in turn requires the adoption of the subsequent one:—

(1) If hæmorrhage starts after the birth of the child, and if it is not checked by massage of the fundus, ascertain whether the placenta is in the uterus or vagina. If the placenta is in the uterus, try the effects of massage for a little longer. If this does

not check the bleeding, or if the placenta was already in the vagina—

(2) Express it by the Dublin method, if possible, and then stimulate the fundus to contract by friction and the administration of ergot. Up to two drachms of the liquid extract of ergot may be given by the mouth, but more certain and rapid in its action is the hypodermic administration of citrate of ergotinin. From $\frac{1}{50}$ to $\frac{1}{25}$ of a grain of the latter may be injected. If this still fails to check the bleeding, or if the placenta cannot be expressed—

(3) Place the patient in the cross-bed position, wash her externally, and douche the vagina with a solution of creolin (ʒss. to a gallon), at a temperature of 110° to 115° F., having first passed a catheter, if this has not been done already. If the placenta is still in the uterus, remove it manually, as will be subsequently described. Then douche out the uterus thoroughly, and administer ergot, if it has not been already administered. If the placenta has been previously removed by expression, and if the vaginal douche fails to check the hæmorrhage, a hot uterine douche is given, creolin solution being used as before. If the bleeding still continues—

(4) Compress the fundus firmly between the fingers of one hand in the anterior fornix and the other hand upon the abdominal wall, thus squeezing out any clots that may be retained, and then repeat the intra-uterine douche.

(5) Introduce the hand into the uterus, and remove any fragments of placenta or of membranes and all clots. Then repeat the intra-uterine douche.

(6) In those cases in which hæmorrhage resists the above treatment there are still two measures from which a final choice can be made. These are, either to plug the utero-vaginal canal with iodoform gauze, or to inject perchloride of iron into the uterine cavity. Of the two, the former is preferable.

The use of perchloride of iron was introduced by Barnes.[*] He recommended that a few ounces of Liq. Ferri Perchlor. (B.P.) be injected into the uterine cavity from which all clots have been removed. Another and perhaps easier method of applying the iron is to add Liq. Ferri Perchlor. Fort. (B.P.) to warm water until a light sherry-coloured fluid is produced. The uterus is douched out with this and then with ordinary creolin solution. Barnes claimed that iron acts in the following manner:—

(*a*) It coagulates the blood in the mouth of the vessels.

(*b*) It constringes the tissues round the mouth of the vessels, and so compresses the latter.

(*c*) It provokes some contraction of the muscular wall of the uterus.

The great advantage of iodoform gauze over iron is that it has no tendency to interfere with the nutrition of the superficial portions of the uterine wall. Iron, on the other hand, causes a considerable superficial necrosis, and, if saprophytic germs gain entrance to this dead tissue, they have a suitable pabulum on which to live. 2 Again, iodoform gauze is as certain as anything can be in its action, and, even if the hæmorrhage is coming from a large vessel which has been torn across owing to a laceration of the uterus, it will in all probability prevent further bleeding. Iron may and sometimes does fail, and, if it fails, it is impossible to resort to plugging, as, owing to the manner in which the tissues have become constringed, gauze could not be introduced.

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[*] *Trans. London Obstet. Society*, vol. vii., 1866

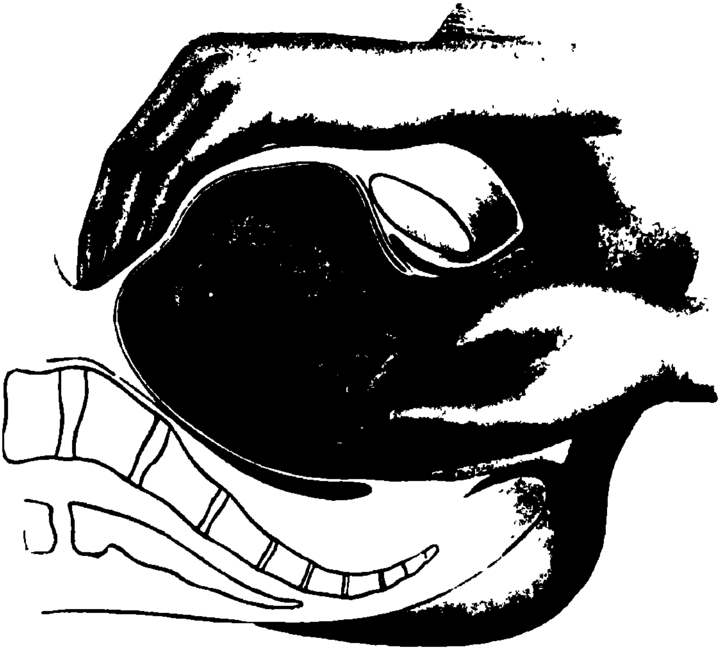

FIG. 369.—BI-MANUAL COMPRESSION OF THE UTERUS IN POST-PARTUM HÆMORRHAGE.

If iron is used, the uterus must be douched out next day, and each subsequent day if there is any rise of temperature.

The foregoing is the mode of treatment which we consider to be most suitable in cases of atonic post-partum hæmorrhage. It is, of course, impossible to follow a stereotyped plan in all cases. Special cases call for special variations in the treatment, and in some instances it may be necessary to resort immediately to the plug owing to the condition of the patient. However, in the majority of cases in which the accoucheur has been in attendance from the onset of the hæmorrhage, it will be possible to follow a system such as the above, and so to save the patient from the risk of intra-uterine manipulations in all but the most serious cases.

There are two procedures which are very frequently recommended, and which have not been mentioned. They are of use in some cases, and, even if they will not finally check the hæmorrhage, they may check it temporarily. / The first of these is compression of the aorta. Unless the patient is very stout or strains very hard, it is comparatively easy to compress the aorta through the abdominal wall against the lumbar portion of the spinal column. It is a procedure which is of value, if we have an assistant capable of performing it, while preparations are being made for intra-uterine treatment. 2 The second procedure is the bi-manual compression of the uterus, not as recommended above with the object of expressing clots, but rather with the object of preventing further hæmorrhage by compressing the bleeding vessels. It is carried out as follows:—Pass the right hand into the vagina and place two fingers behind the cervix in the posterior fornix. With these fingers press the cervix forwards in such a manner as to fold it beneath the body of the uterus (*v.* Fig. 366). Then, compress the latter as firmly as possible between the vaginal hand and the left hand placed upon the abdominal wall. This procedure is also of use only in order to gain time, as it will rarely finally arrest the hæmorrhage.

There are a few methods of treatment against which the author would like to warn the student./ These are the intra-uterine injection of vinegar, the freedom of which from bacteria can never be assumed;²the application of ice or the pouring of cold water on the patient's abdomen, a practice which is sufficient to determine the death from heart failure of a collapsed patient; the introduction of ice into the uterus, both on account of the risk of sepsis and of the shock it causes;⁴the injection of ergot before the placenta has left the uterus, unless we are prepared to remove it immediately;⁵and the plugging of the uterine cavity with any material which is not sterile.

Prognosis.—The prognosis of post-partum hæmorrhage is always good, if the case is taken in time. A woman can lose immediately after delivery, without being very much affected, an amount of blood which at another time would bring her to the point of death.

CONCEALED ATONIC HÆMORRHAGE.—The term 'concealed atonic hæmorrhage is applied to post-partum hæmorrhage when the escaped blood is stored up in the uterus instead of pouring out through the vulva./ It is to a large extent an artificial condition, that is to say, it is caused by the attendant compressing the lower uterine segment instead of the fundus, and so placing an obstruction in the way of the escape of the blood. ² If the fundus is not properly controlled, concealed hæmorrhage may also occur behind a detached placenta which is blocking the lower uterine segment. If it occurs, it is recognised by the increase in size of the uterus. Its treatment consists in immediately removing the obstruction to the escape of blood, and then emptying the uterus by expression. If the hæmorrhage still continues, the further treatment of the case is similar to that of external atonic hæmorrhage.

SECONDARY POST-PARTUM HÆMORRHAGE

The term secondary post partum hæmorrhage is applied to bleeding coming on more than six hours after the completion of labour. It is also known as puerperal or late hæmorrhage.

Frequency.—At the Rotunda Hospital, in which patients remain for eight days after their confinement, 26 cases of secondary hæmorrhage occurred in 20,000 confinements, a proportion of 1 in 769·23.

Etiology.—Secondary post-partum hæmorrhage may arise in three ways:—

(1) Owing to the separation of the thrombi in the mouths of the uterine bloodvessels. This may occur as a result of a sudden increase in the blood-pressure, or of the sloughing of the coats of a vessel as a result of a long-continued pressure during labour.

(2) Owing to a congested condition of the endometrium. The commonest cause of congestion of the endometrium during the puerperium is a relaxed condition of the uterus. This condition, which is known as sub-involution, may be caused by the retention of pieces of placenta or membrane, malpositions of the uterus, fæcal accumulations, or by the patient getting up too soon after labour.

(3) Owing to the presence of tumours, either pre-existing or arising subsequent to delivery. Amongst pre-existing tumours, myomata of the body of the uterus are the commonest. The only tumour which is likely to form subsequent to delivery is chorion-epithelioma.

Treatment.—If the hæmorrhage is slight, the administration of ergot in full doses, the expression of all clots from the uterus, and absolute rest in bed, may be sufficient to check it. If it does not cease, or if it is severe from the start, the vagina and uterus should be douched out with hot creolin lotion, and the latter explored with the fingers in order to ascertain the cause of the hæmorrhage. a If a retrodeviation of the uterus is present it must be corrected, and a pessary inserted if the uterus does not remain in the normal position. b If a portion of placenta has been left behind, it must be removed with the finger or blunt curette. c If hæmorrhage still continues, the uterine cavity must be plugged with iodoform gauze. d In addition, the bowels must be regulated, and the administration of ergot continued for some days. 3 If the hæmorrhage is due to the presence of a myoma, and the bleeding cannot be checked by the use of ergot, hot douches, and plugging, it may be necessary to discuss the advisability of hysterectomy or myomectomy, according to the situation of the tumour. If the latter is pedunculated, it can, of course, be easily removed. Indeed, this should be done in all cases as soon as the condition is recognised, as the risk of the sloughing of such a tumour after delivery is very considerable. Chorion-epithelioma admits of but one treatment—immediate and complete hysterectomy.

POST-HÆMORRHAGIC COLLAPSE

The very favourable results which attend the early recognition and treatment of post-hæmorrhagic collapse are so marked that it is deemed advisable to devote a separate section to this condition.

Symptoms.—The symptoms of collapse due to excessive loss of blood are characteristic. At first, there is no noticeable change in the condition of the patient, save a slight increase in the frequency of the heart. As the hæmorrhage continues this becomes more marked, and the pulse at the same time becomes small and feeble. Gradually, the aspect of the patient becomes blanched, the sclerotics especially being of a pearly white colour. respiration is more hurried, and the patient frequently sighs. This condition, which is known as air-hunger, is the result of the lessened amount of oxygen which the diminished blood-stream carries to the tissues and the medulla oblongata. If the temperature is taken, it is found to have fallen from one to three degrees. As the hæmorrhage continues, the above symptoms become more marked. The pulse becomes uncountable and finally imperceptible, and the body is covered by a cold sweat. Hurried respiration is replaced by dyspnœa, and the patient, struggling for breath, requests to be raised as high as possible. If this is done, she probably loses consciousness momentarily, or the sudden elevation of the head may be even sufficient to cause the final failure of the heart. She gradually becomes more and more restless, complains of inability to see, and finally becomes comatose, with perhaps occasional convulsive movements.

Treatment.—When a patient loses a large quantity of blood, death threatens, not because there is an insufficient quantity of blood in the body, but because the bloodvessels have not as yet had time to suit their capacity to the diminished amount of fluid which they now contain. As a matter of fact, a woman greatly collapsed from post-partum hæmorrhage is said to have as many red blood corpuscles in her body as an anæmic girl. In consequence of the unfilled condition of the vessels, blood does not return to the heart in sufficient quantities, the latter has nothing to contract upon, and, as a result, its contractions become more and more feeble, and an insufficient quantity of blood is nt to the brain. In consequence of the resulting anæmia of the rain, feeble stimuli are transmitted to the heart, which fails still more, a vicious circle being thus established. Reasoning from is, we see that, to successfully combat the tendency to cardiac ilure, our treatment must be directed towards three points:—

(1) The heart must be directly stimulated. Direct stimulation f the heart can be performed by the administration of alcohol by he mouth; by the hypodermic injection of ether, strychnine, or randy; by the rectal injection of brandy or coffee; and by the se of hot fomentations over the præcordial area. In administerng alcohol by the mouth, we must be careful not to give it in uch large quantities as to cause vomiting. Half an ounce may e given at first of a mixture of one part of whisky or brandy in wo parts of water, followed by a teaspoonful of the same every ive or ten minutes. From twenty minims to a drachm of ether may be injected hypodermically, and from one twenty-fifth to ne-tenth of a grain of sulphate of strychnine. Two or three syringefuls of brandy may be used instead of ether, the latter is, however, preferable. From half an ounce to an ounce of brandy or whisky, mixed with from four to eight ounces of strong, hot coffee, may be injected into the rectum.

(2) The diminished quantity of blood must be limited as far as possible to the vital organs of the body, *i.e.*, the brain and viscera. This is a most important point, and one which is frequently forgotten during the carrying out of the necessary measures for checking the hæmorrhage. An even momentary diminution in the amount of blood which is going to the brain, due to some sudden elevation of the patient's head, may prove fatal. While the patient is in the cross-bed position all pillows must be removed from beneath her head, and, if her condition is serious, the limbs must be tightly bandaged from below upwards, in order to drive the blood from them to the more important parts of the body. So soon as the bleeding has been checked, and the patient has been returned to bed, the bottom of the latter must be raised from six inches to a foot by placing bricks or other sufficiently firm support beneath the legs. Subsequently, as the patient improves, the bandages may be removed, and the foot of the bed brought gradually back to its former level.

(3) The amount of fluid in the bloodvessels must be increased. The amount of fluid in the bloodvessels can be increased in the following ways:—By administering abundance of fluid by the mouth; by rectal injections of salt and water; and by infusing saline solution directly into a vein, or into the subcutaneous connective tissue. As thirst is always present to a marked degree in these cases, it is never difficult to get the patient to drink large uantities of fluid as soon as she has rallied somewhat from her ollapse. It is not, however, a method of increasing the fluid in he body which can be adopted at first, as sufficient quantities to ave any effect in this direction would almost certainly cause

vomiting. Rectal injections of saline solution of the same strength as that infused into a vein (0·6 per cent., roughly a teaspoonful of salt to a pint of water) will be absorbed most quickly. From one to two pints may be given, and repeated at intervals of two or three hours. It must be injected very slowly, as otherwise the patient will not retain it.

Direct intravenous infusion of saline solution is the most rapid method of increasing the amount of fluid in the bloodvessels. It is a course of procedure which, while it has many supporters, has also a number of opponents on the grounds of its danger and uselessness. If it is carefully carried out, the risk attending it is by no means great, while doubts with regard to its value are most probably due to the fact that it is suffering at present from the results of previous overestimation. Intravenous infusion will not bring back to life a patient who is in the last stage of collapse from hæmorrhage, but, if it is performed before this stage is reached, it will in all probability prevent her from falling into such a state. To render the proceeding of use, a sufficient quantity of fluid at a proper temperature must be infused. The necessary amount will vary between three and six or even eight pints. No definite quantity can be fixed which will suit all cases, but the infusion must be continued until there is a marked increase in the volume and strength of the pulse. The solution is used at a temperature of 100° to 102° F.

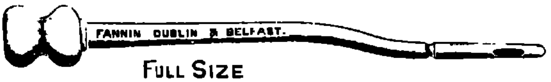

FIG. 370.—HOSSACK'S CANULA FOR INTRAVENOUS INFUSION.

In order that the proceeding may be as free from danger as possible, everything used in the operation must be sterile, and due precautions must be taken to prevent the entrance of air along with the fluid. The apparatus used consists of the following implements.—A glass or metal funnel capable of holding at least two ounces; a rubber tube of about three feet in length; a small silver or white metal canula with a blunt point; and a scalpel, dissecting forceps, small needles, needle-holder, and fine silk. The operation is performed as follows:—Tie a bandage round the upper arm sufficiently tightly to compress the veins but not the arteries. By this means the veins below the bandage stand out sufficiently to be seen, and a suitable one can be selected. Expose the latter by means of an incision about an inch in length made directly over it, isolate a small portion of it, and slip two silk ligatures beneath it. Then, tie the distal ligature to prevent hæmorrhage. A longitudinal incision of sufficient length to admit the tip of the canula is made in the vein, and the canula is introduced, care being taken that it is filled with saline solution.

Next, tie with a single knot the proximal ligature in such a manner as to compress the vein against the canula, in order to prevent the escape of fluid, and remove the bandage which was compressing the arm. Before the canula is introduced the entire apparatus must be filled with saline solution, its escape being prevented by pressure upon the tube. The fluid is now allowed to flow, an assistant taking care that the funnel is always full, and that no air gains admission. By holding the funnel from ten to eighteen inches above the patient, a sufficient pressure is obtained. As soon as the required quantity of fluid has been infused, the canula is removed, the vein cut across, the second ligature tied tightly, and the skin wound closed with sutures.

Infusion into the cellular tissue has been substituted by many obstetricians and surgeons for intravenous infusion, on account of the greater ease with which it is carried out. Kelly, who prefers it to all other means of infusion, injects the fluid into the submammary cellular tissue. For this purpose, he uses graduated bottles capable of holding a couple of pints, to which a tube eight feet in length is connected. A long, slender, and sharp aspirating needle is fastened to the other end of the tube. The solution used is the same as for intravenous infusion, and a head of six feet is required to make the fluid run. To perform the operation, the breast, after careful disinfection, is seized in the hand and lifted as far off the chest wall as possible. The needle, with the saline solution flowing, is then passed through the skin at the base of the breast and deeply into the connective tissue, taking care to keep clear of the gland structure. The fluid then runs in of its own accord, and as soon as no more will flow the needle is withdrawn. A piece of adhesive plaster fastened over the opening will prevent its subsequent escape. The breast will hold from a pint and a half to two pints, and the time required to infuse this amount is about twenty minutes. A similar amount, if necessary, can be infused at the same time under the other breast. Instead of into the breast, the fluid may be infused into the connective tissue of the buttock, but the former site is preferable.

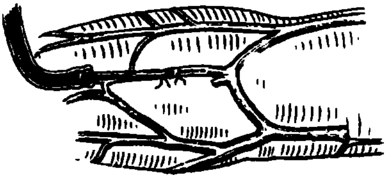

FIG. 371.—THE CANULA INTRODUCED INTO THE MEDIAN VEIN JUST BELOW THE BEND OF THE ELBOW

The above is a short description of the immediate treatment necessary in post-hæmorrhagic collapse. It must not, however, be thought that, as soon as the patient has rallied, all danger is at an end. The resultant enfeebling of the circulation carries with it many dangers from which she cannot be regarded as safe for a considerable time. The most common of these is cardiac syncope coming on at any attempt at exertion. Pulmonary embolism may also occur, due to the detachment of a thrombus whose formation has been favoured by the weak action of the heart. Crural phlegmasiæ may occur from a like cause, and, as happens in all debilitating conditions of the patient, the natural resistance of the system to septic invasion is so lowered that the risk of infection is greatly increased. In consequence of the tendency to cardiac failure, the patient must not be allowed even to sit up in bed during the first week or so, and all attempts at raising herself must be strictly forbidden. The process of getting up must be a most gradual one, and, even after she is able to walk about, she must carefully avoid all sudden or violent exertion. In order to promote her convalescence, the administration of iron in tolerably large doses will be found of considerable benefit. Careful attention to the dietary, and the judicious use of stimulants, are also matters of vital importance.

IV-RETENTION OF THE PLACENTA

The retention of the placenta in the uterus after delivery is one of the most common complications of labour. In many cases, if sufficient time was allowed to elapse, spontaneous expulsion would eventually take place, but, in some cases, the placenta would be retained *in utero* indefinitely until perhaps it was discharged piecemeal in a sloughing condition. We stated, when discussing the management of the third stage of labour, that, if the uterus did not expel the placenta spontaneously within an hour after the birth of the fœtus, steps must be taken to cause its expulsion or it must be removed. In the present section, we shall deal with the causes of placental retention, and the method of removing the retained placenta.

Frequency.—The manual removal of the placenta, either on account of the occurrence of post-partum hæmorrhage or the retention of the placenta in the uterus for more than an hour, had to be performed in 259 cases out of a total of 20,000 labours at the Rotunda Hospital, a proportion of one in 77·22.

Ætiology.—The chief causes of placental retention are insufficient or irregular contractions of the uterus, dense adhesions between the placenta and the uterus, and abnormalities in the shape of the placenta. It is easy to understand why the absence or the insufficiency, of uterine contractions should cause retention of the placenta, in the same manner as feeble contractions fail to effect the expulsion of the fœtus. Irregular contractions of the uterus are a rarer cause of retention. In some cases, the fibres of the body of the uterus contract circularly below the placenta, giving rise to the so-called hour-glass contraction of the uterus, and, in other cases, the contractions may occur at the level of the retraction ring. The probable causes of such contractions are the administration of large doses of ergot during the third stage of labour, and the irritation of the uterine muscle either by irregular massage through the abdominal wall of the lower part of the uterine body, or by clumsy efforts to introduce the fingers into the uterine cavity. Their result is to bring about an incarceration of the placenta above the area of contraction. Morbidly dense adhesion between the placenta and the uterine wall is usually the result of a former decidual endometritis, and is perhaps the most common cause of placental retention. The principal malformations of the placenta that cause its retention are a placenta membrancea, which in consequence of its want of solidity is crumpled up inside the contracting uterus instead of being detached, and a placenta succenturiata in which one or more of the detached cotyledons may be retained.

Treatment.—In all cases of placental retention, unless the presence of irregular contractions has been diagnosed, the first step consists in endeavouring to express the placenta. This is done by seizing the fundus of the uterus in the hand applied over the abdominal wall and firmly compressing it from side to side and from above downwards, while at the same time making slight downward pressure. As soon as the placenta passes into the vagina, it is expressed from the latter in the usual manner. If, however, irregular contractions are present, all massage or friction of the uterine wall should be stopped for a few minutes, then, if the contractions pass off, expression may be tried. If the irregular contractions do not pass off, manual removal of the placenta must be performed, and this must also be done in all cases in which expression fails.

The manual removal of the placenta was formerly regarded as one of the most serious operations in obstetrics, and rightly so, owing to the high rate of morbidity, if not of mortality, by which it was followed in consequence of septic infection. The operation, if not carried out with the strictest attention to asepsis, is especially prone to give rise to septic infection, on account of the intimate relation into which the fingers are brought with the uterine sinuses. If, however, proper precautions are taken, this risk can be very greatly minimised, and, if rubber gloves are always used by the operator, the risk is very small indeed. To perform the operation, the patient is placed in the dorsal cross-bed position, and, if necessary, an anæsthetic may be administered. It is, however, well to dispense with the latter if possible, as it probably weakens the subsequent contractions of the uterus and so favours hæmorrhage. After thorough disinfection of the external parts, the hand covered with a rubber glove is passed into the vagina and pushed gently upwards in the form of a cone, the other hand being placed over the fundus to push it downwards within reach. If spasmodic contraction of any part of the uterus offers an obstacle to the introduction of the hand, extreme gentleness must be used in passing the hand through the contracted area, as it is possible to lacerate the uterus by forcible efforts at introduction. If the hand cannot be passed upwards, owing to the tightness of the stricture, an anæsthetic must be administered, and the spasm will probably pass off. As soon as the hand has passed into the cavity, the fingers feel for

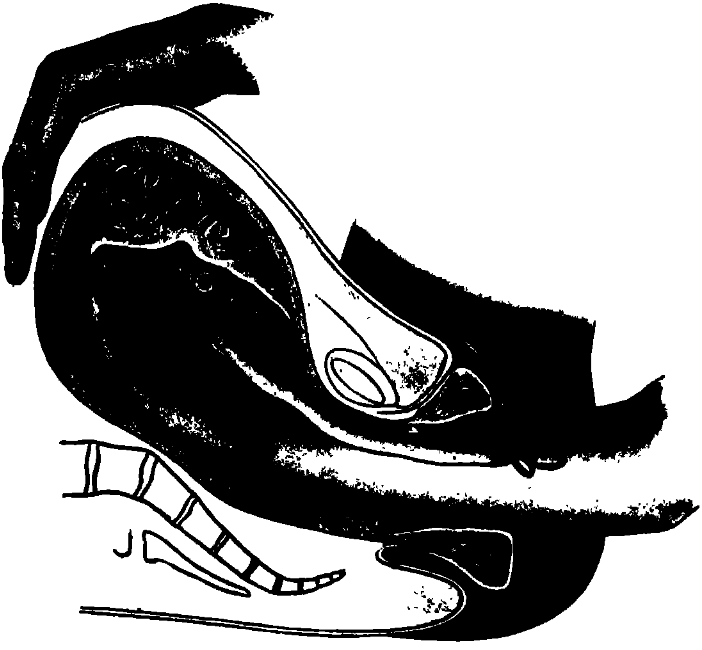

FIG. 372.—THE MANUAL REMOVAL OF THE PLACENTA.

the lower edge of the placenta, and, with a to-and-fro sawing motion of their tips, the placenta is gradually separated from below upwards. As soon as it has been completely detached, it is grasped in the fingers and drawn out, if possible in a single piece. 3 The hand is then again introduced, and the uterus is examined to ascertain if any pieces of placenta or membrane have been left behind. 4 When all the fragments have been removed, the uterus must be douched thoroughly. 5 During the removal of the placenta, an assistant may administer a hypodermic injection of ergot in order to ensure subsequent contraction of the uterus.

CHAPTER X

GENITAL TRAUMATA

Rupture of the Uterus—Threatened Rupture—Sudden Rupture—Gradual Rupture. II Lacerations of the Cervix. III Lacerations of the Vagina, Perinæum, and Vulva. IV Rupture of the Pelvic Articulations. V Inversion of the Uterus.

GENITAL traumata will be divided into the following groups:—

I. Lacerations of the supra-vaginal portion of the uterus, commonly known as rupture of the uterus.
II. Lacerations of the infra-vaginal portion of the uterus, *i.e.*, cervical lacerations.
III. Lacerations of the vagina, perinæum, and vulva.
IV. Rupture of the pelvic articulations.
V. Inversion of the uterus.

We shall discuss each of these groups separately.

I RUPTURE OF THE UTERUS

Rupture of the body of the uterus is one of the most serious complications of labour. It may occur in any part of the body, though in practice it almost always commences in the lower uterine segment.

Frequency.—It is difficult to estimate the frequency of rupture of the uterus during labour, as the number of cases which occurs in maternity hospitals is greater than is the true proportion. The proportion is usually stated to be 1 in 3,000 to 5,000, and according to statistics collected in Paris (Jolly), based on 782,741 labours, it is 1 in 3,403. At the Rotunda Hospital, rupture of the uterus occurred ten times in 20,000 cases, a proportion of 1 in 2,000.

Ætiology.—The causes of rupture of the uterus may be divided into three classes:—Obstructed delivery; direct traumatism; degeneration of the uterine muscle. [illegible] 90 [illegible]

1 Obstructed delivery is the most common cause. If the uterus cannot expel the fœtus, one of two things happens—either a condition of secondary uterine inertia supervenes, or rupture of the

lower uterine segment occurs. In consequence of prolonged labour and undue retraction of the muscle fibres, the upper uterine segment becomes progressively thicker and of smaller capacity, the lower segment thinner and of greater capacity, and eventually this thinning is carried to such an extent that the walls cannot stand the strain to which they are subjected, and rupture occurs. Such a rupture may extend in various directions. It may continue upwards into the thickened fundus, downwards into the cervix and vaginal vault, or circularly round the lower segment. In the last case, the lower segment may be completely torn away from the upper segment. A less common manner in which rupture occurs is by the *attrition* or rubbing through of a portion of the uterine wall which has become nipped between the

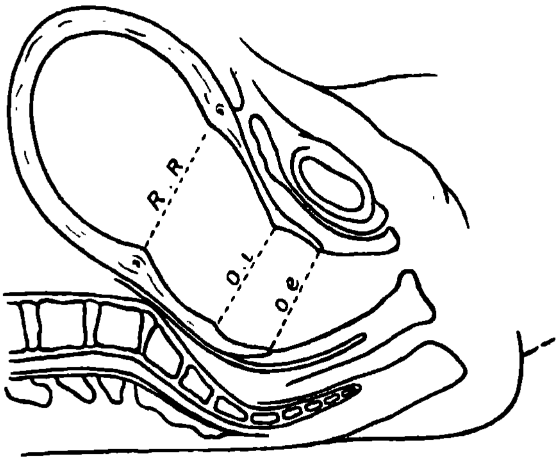

FIG. 373.—DIAGRAM REPRESENTING APPROXIMATE POSITION OF THE RETRACTION RING AFTER A PROLONGED LABOUR.

R R., Retraction ring; *o.i.*, os internum; *o.e.*, os externum. (Schroeder

descending head and an overhanging sacral promontory or a bony exostosis. In these cases, a hole may be rubbed in the tissues, or, as a result of the long-continued pressure, necrosis of the tissues may occur and a fistulous opening form during the puerperium. In this manner, an opening may be made into the bladder by an exostosis on the posterior surface of the symphysis, or into Douglas' pouch by the pressure of the promontory.

Direct traumatism, sufficient to cause rupture, may result from any form of intra-uterine operation, whether manual or instrumental. The commonest causes are perforation of the uterus with the blade of the forceps or other instrument, and ill-advised efforts at internal version in cases in which the degree of retraction of the uterus contra-indicates such efforts. In such cases, rupture usually occurs in the lower uterine segment.

Degeneration of the uterine muscle is a very rare occurrence, but cases of rupture which have been proved to be due to such a cause have been reported from time to time, and are usually known as 'spontaneous rupture.' The nature of the degeneration varies in different cases. Jardine[*] records a case in which 'the muscle fibres at the actual seat of rupture were, for the most part, atrophied and shrunken, and in many places exhibited transverse or irregular fractures of the muscle substance. Nuclear staining in the fibres was absent.' In another case of spontaneous rupture recorded by Poroschin,[†] the muscle fibres were cloudy, slightly outlined, and with pale nuclei; but more striking was the complete absence of elastic fibres, save in the walls of the vessels. Poroschin concluded from this that the rupture was due to the absence of elastic fibres. Dakin[‡] recorded a similar case in which there was marked fatty degeneration of the fibres. If pregnancy occurs in a case of cancer or of tuberculous disease of the body of the uterus, rupture may occur during labour in the diseased tissues. As a rule, however, in such cases pregnancy does not occur. Rupture occurring in cases of degeneration of the fibres may involve any part of the uterine wall, and will naturally occur at the site of maximum structural alteration. Cases in which rupture occurs in the cicatrix of a former Cæsarean section may be also included in this class, inasmuch as rupture is due to the altered or incompletely formed fibres of the scar tissue.

Pathological Anatomy.—Rupture, the result of obstructed delivery, usually commences in the lower uterine segment, and may extend in any direction; while rupture, the result of degeneration of the fibres, may occur at any part of the uterus, corresponding to the seat of maximum degeneration of the fibres. The character of the rupture varies considerably. Usually, it is an irregular tear of varying size, while in cases of attrition or rubbing through it is more or less circular and accompanied by actual loss of tissue. According to the site, and the direction in which the rupture extends, the latter may involve the part of the uterus which is covered or uncovered by peritoneum. If it extends through the peritoneal investment, it is known as a 'complete rupture'; while, if the peritoneal investment remains intact, or if the rupture is situated below the line of peritoneal reflexion, it is known as an 'incomplete rupture.' This was a very important distinction in pre-antiseptic days, when the great danger of rupture was the extension of infection from the uterus to the peritoneal cavity. Now, however, since we are better able to maintain uterine asepsis, the relative importance of the involvement or escape of the peritoneum is not so great, and a more important distinction between ruptures is that some are so situated that they open into large vessels and cause profuse hæmorrhage, whilst others do not do so. Ruptures occurring below the line of peritoneal reflexion may extend into the bladder or the anterior or lateral vaginal vaults, or may involve the structures in the broad ligaments. In the last case, the tear may result in the formation of a hæmatoma in the broad ligament. Complete intra-peritoneal rupture may result in the escape of the fœtus and placenta in part or altogether into the peritoneal cavity, and sometimes in profuse intra-peritoneal hæmorrhage.

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[*] 'Clinical Obstetrics' (Rebman and Co., 1903), p. 421.

[†] *Cent. für Gynäk.*, Feb., 1898.

[‡] *Trans. Obstet. Soc. Lond.*, vol. xl.

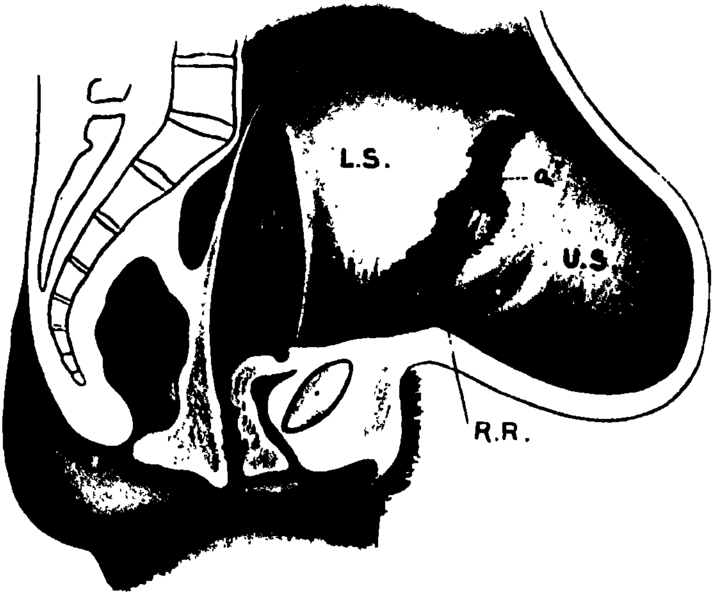

FIG. 374 —DIAGRAM TO SHOW A RUPTURE OF THE LOWER UTERINE SEGMENT IN CONSEQUENCE OF THE IMPACTION OF A HYDROCEPHALIC HEAD AT THE PELVIC BRIM

H., Fœtal head. L.S., lower uterine segment; U.S., upper uterine segment R.R., retraction ring; *a*, rent in lower segment.

Symptoms.—The symptoms of rupture of the uterus depend mainly upon the situation and size of the rupture, and the degree of suddenness with which it occurs. In some cases, a rupture of large size, and involving important bloodvessels, occurs with the greatest suddenness, and causes correspondingly well-marked symptoms; whilst, in other cases, the rupture takes place gradually, gives rise to but slight hæmorrhage, and consequently at first causes no special symptoms. Accordingly, we shall consider the symptoms of rupture in two groups—the symptoms of gradual rupture, and the symptoms of sudden rupture. To these, we shall also add a third group—the symptoms of threatened rupture, as they are usually distinct and well-marked.

Threatened Rupture.—The symptoms of threatened rupture have been already discussed when dealing with the symptoms of unduly prolonged labour.* They consist in the main of the various signs that retraction has been carried farther than is safe.

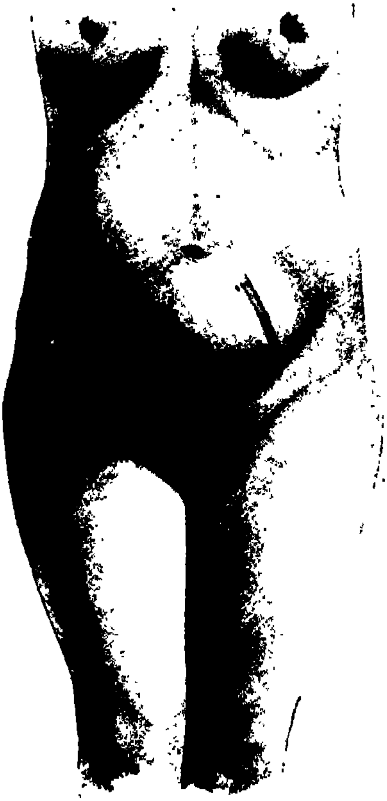

FIG. 375.—DIAGRAMMATIC REPRESENTATION OF THE STANDING OUT OF THE ROUND LIGAMENTS IN THREATENED RUPTURE OF THE UTERUS (Bumm.)

The contractions become very frequent or sometimes tonic,[2] the retraction ring rises to a level of more than an inch and a half above the pubis;[3] the uterus is tender to the touch;[4] and the round ligaments—one or both—can be felt as tense cords. The constitutional effect of the prolonged labour shows itself in an increase in the rate of the pulse and of respiration.

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* *Vide* Part IV., Chap. II., p. 293.

2 **Gradual Rupture.**—The symptoms that one would expect to find in gradual rupture are as follows:—1 A gradually increasing collapse of the patient, due to hæmorrhage, with all the usual accompanying symptoms; 2 steadily increasing pain in and tenderness of the abdomen; 3 the gradual cessation of uterine contractions; 4 the gradual recession of the presenting part if it is not fixed; 5 a varying degree of hæmorrhage *per vaginam;* and, in cases in which the fœtus escapes into the abdominal cavity, the presence of another tumour resembling a fœtal head at one side of the false pelvis, and formed by the empty uterus. On the other hand, the fœtus may be expelled by the natural efforts, there may not be any symptoms to call attention to any abnormal condition, and it may only be after the expulsion of the fœtus that the occurrence of hæmorrhage or the retention of the placenta—owing to its escape into the abdominal cavity—shows that something abnormal has happened.

Sudden Rupture.—The symptoms of sudden rupture, in which an extensive tear of the uterine wall occurs, are well marked. The patient is probably in the act of straining violently in the course of a contraction, when suddenly she screams out in violent pain, and declares that something has torn internally. The uterine contractions, as a rule, immediately cease, but the pain continues. If the rent is sufficiently great, a portion of or the whole fœtus escapes into the peritoneal cavity, and the presenting part—if not fixed recedes from the brim. At the same time, there are the constitutional symptoms of profound shock:—A weak and thready pulse, usually very rapid, but occasionally abnormally slow; a rapid fall of temperature; and increased frequency of respiration. These symptoms are, as a rule, due to the accompanying hæmorrhage, but they may also be the result of profound shock.

Diagnosis.—The diagnosis of gradual rupture may be extremely difficult, inasmuch as there may not be anything to call attention to what has occurred. In cases in which the symptoms are progressive, and mainly due to hæmorrhage, the diagnosis has to be made between concealed accidental hæmorrhage and rupture. This ought not to be a difficult matter. Concealed hæmorrhage sufficient to cause symptoms does not occur in the second stage of labour in the presence of strong contractions. If the placenta became detached in such a case, the hæmorrhage would either become external, or would be checked by the intra-uterine pressure. Further, in concealed hæmorrhage the uterus would increase in size, whereas in cases in which rupture is likely to occur, or has occurred, the previous contractions have brought the uterine wall into close apposition with the fœtus. When the fœtus escapes into the peritoneal cavity, it will be felt more distinctly by abdominal palpation, inasmuch as it will be covered by the abdominal wall alone instead of by the abdominal wall and the uterus. The empty uterus also can be felt at one side, and has to be distinguished in this position from the head of a second child or of a double monster, or a uterine or ovarian tumour. If the patient has not been examined prior to rupture, it may be most difficult to do this; but, if she has been examined, the appearance of a tumour, which was not there at the commencement of labour, will suggest the possibility of uterine rupture. The recession of the presenting part will confirm the diagnosis of rupture, and, if there is still room for doubt, the end of a Bozemann's catheter may be passed carefully into the uterine orifice and upwards. If the small tumour at the side of the false pelvis is the uterus, the catheter can be passed into it.

The diagnosis of sudden rupture is more easily made, inasmuch as the symptoms are usually very definite. The feeling of something having given way internally, the sudden cessation of the contractions, and the recession of the presenting part, are all characteristic. In every case, an exact diagnosis must be made after the delivery of the fœtus, and the situation and size of the rent be ascertained.

Treatment.—The treatment of uterine rupture must be considered under two headings—prophylactic treatment, and active treatment.

Prophylactic Treatment.—The prophylactic treatment of rupture is of the greatest importance. If, in all cases of labour, the obstetrician watches carefully for the appearance of any of the symptoms of threatened rupture, and on their appearance acts in accordance with their indications, rupture will never occur save in the few isolated cases in which it is due to a degeneration of the uterine muscle, of which it is impossible to obtain any forewarning.

The first point in the prophylaxis of uterine rupture consists in removing so far as possible all obstruction to the expulsion of the fœtus. Malpresentations of the latter must be changed. Obliquities of the uterine axis must be corrected, and the axis brought into line with that of the brim. Tumours must be pushed out of the way or removed, and rigidities of the soft parts dilated or incised. A common cause of obstruction, and one which may lead to rupture of the uterus, consists in the nipping of the anterior lip of an imperfectly dilated cervix between the descending head and the symphysis (*v.* Fig. 376). If a large portion of the lip is thus prevented from retracting upwards, it may form a barrier sufficient to prevent the descent of the head unless the latter carries the obstacle away before it. If the position of the lip is recognised in time, it can be easily remedied by pushing up the prolapsed portion in the interval between the contractions, and keeping it up with the finger during one or two contractions. If this is done, the head will descend, and, at the same time, the cervix will retract upwards, and the nipping of the tissues will not recur.

The next point in the prophylaxis of uterine rupture consists in the immediate emptying of the uterus if any symptoms of threatened rupture appear, and in doing so by some means that will not increase the tension of an already overstrained uterine wall. Once marked symptoms of threatened rupture have occurred, all attempts at version or any form of intra-uterine manipulation are contra-indicated. Delivery in head cases must be effected by the

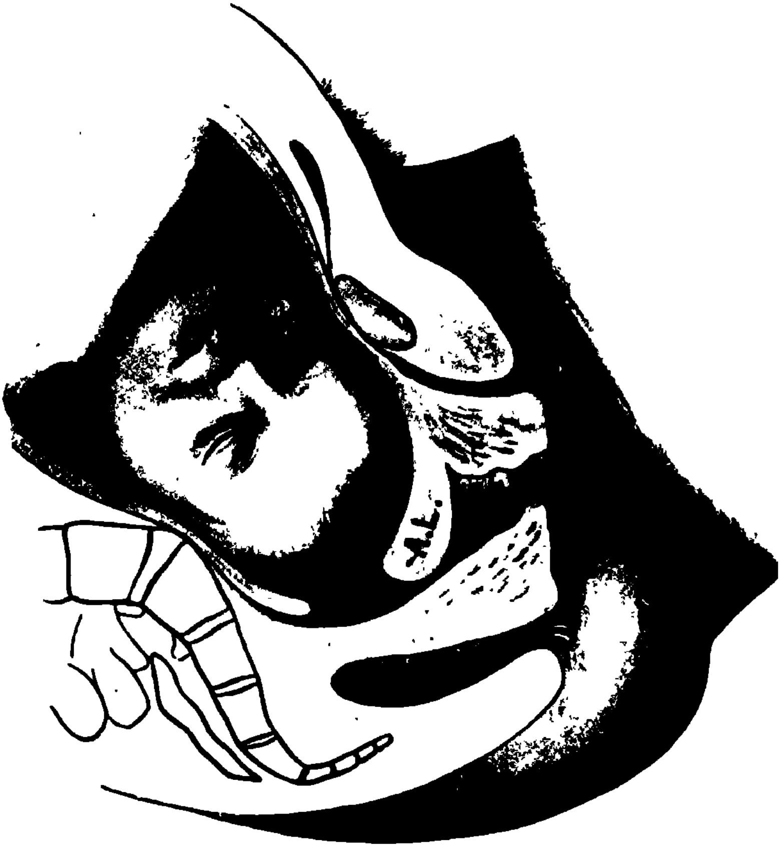

Fig. 376.—Diagrammatic Representation of Nipping of the Anterior Lip of the Cervix by the Head in a Case of Flat Pelvis.

A.L., Anterior lip.

forceps or the cranioclast; in a pelvic presentation, by extraction as a foot or breech presentation; and, in a neglected shoulder presentation, by decapitation or embryotomy. In almost every case in which marked symptoms of threatened rupture are present, the fœtus will have died as a result of the long-continued labour, and consequently there need be no hesitation in performing craniotomy if the condition of the mother necessitates it.

Active Treatment.—The proper course to adopt in cases of rupture of the uterus is still the subject of considerable difference of opinion, and, consequently, it is impossible to lay down dogmatic directions to be followed under all circumstances. The first difficulty in the way of determining the correct treatment lies in the difficulty of making an accurate diagnosis—not of the occurrence of rupture, as that is comparatively simple, but of the extent of the rupture, the size of the bloodvessels which have been opened, and the involvement of neighbouring viscera. The second difficulty lies in the making of a correct prognosis, or even an approximately correct prognosis, as to how a particular case will terminate. If these two difficulties are surmounted, there is still a third, that of carrying out the treatment indicated under the conditions in which one finds the patient. These three difficulties make the question of the correct treatment a most complex one.

The first step to be taken in any case of rupture, and perhaps the only one about which there is no difference of opinion, consists in delivering the fœtus, if it has not been already expelled. If the fœtus is in the uterus, delivery is effected through the vagina, by the forceps, traction on the leg, craniotomy, or embryotomy. Under no circumstances is version permissible, on account of the danger of increasing the size of the rent. Where a small part of the fœtus, such as a limb, has escaped through the rent into the peritoneal cavity, delivery may still be effected through the vagina, as such a part can be drawn back through the rent without danger, but, where a considerable portion of the fœtus or the whole fœtus has escaped, delivery by the vagina is impossible. In such cases, an immediate cœliotomy must be performed, and the fœtus extracted through the opening in the abdominal wall.

Delivery being effected, we must next decide what shall be done with the lacerated uterus. There are several methods of treatment from which to select :—

(1) The case may be left without special treatment other than the free administration of ergot, in the hope that the uterine contractions will close the rent and prevent hæmorrhage.

(2) The uterine and vaginal cavity may be plugged with iodoform gauze; a firm compress and tight binder applied above the uterus, with the object of compressing it against the plug; and ergot freely administered.

(3) The rent may be plugged with iodoform gauze in order to check hæmorrhage, and at the same time to drain the peritoneal cavity.

(4) Abdominal cœliotomy may be performed and the rent sutured.

(5) Abdominal cœliotomy may be performed and the uterus removed.

Before discussing these different methods of treatment, however, we must endeavour to determine a clinical classification of ruptures based on the treatment they require.

From a purely clinical point of view, ruptures may be divided into two classes—uncomplicated and complicated. a By an uncomplicated rupture, we mean one in which there is no accompanying or consequent condition that calls for special treatment; 2 while, by a complicated rupture, we mean one in which there is such an accompanying or consequent condition. The principal complications which may be associated with, or may result from, uterine rupture are 1 the escape of the fœtus or placenta into the peritoneal cavity; 2 hæmorrhage; 3 extension of the tear into the bladder; 4 prolapse of intestines or omentum through the tear in the uterus; 5 and co-existing septic infection of the uterus.

It is at once obvious that uncomplicated and complicated ruptures differ widely from one another. 1 In the case of an uncomplicated rupture, we have solely to consider what is the best means of promoting the repair of the laceration, and of preventing the occurrence of septic infection; 2 while, in a complicated rupture, we have also to consider what is the best treatment to be adopted for the complication, which sometimes is more important than the rupture itself.

1 If the rupture is uncomplicated and is slight, it may completely escape notice, and indeed it is probable that such cases occur not infrequently, and that the patient suffers little or no bad effect from them. 2 If the rupture is detected, as sometimes it may be during the manual removal of a retained placenta, no special treatment is required other than the administration of ergot to promote contraction, and the careful watching of the patient to see that hæmorrhage does not occur. 3 If the rupture is of larger size but is still uncomplicated, it may be advisable to pass a gauze drain through it in order to facilitate the escape of any liquor amnii or other fluid which may have found its way into the peritoneal cavity. This drain should be introduced with the most careful attention to asepsis, and, if the conditions of the case are such as to render asepsis impossible, it is very much better to refrain from all forms of active treatment. If the gauze is introduced, it must be removed in twenty-four hours, and, if the patient's temperature is normal, it need not be again introduced.

In complicated ruptures, the treatment depends upon the nature of the complication. 1 Cases in which the fœtus has escaped into the peritoneal cavity have been already discussed. Abdominal section must be performed, the abdomen being opened in the middle line and the fœtus extracted. If no other complication is present, and the rent is a clean-cut one and accessible, it may be sutured. If it is very large and ragged, it is probable that supra-vaginal or complete hysterectomy will have to be performed.

2 In cases complicated by hæmorrhage, a great deal depends

upon whether the blood is escaping into the uterine or peritoneal cavity. If the hæmorrhage is intra-uterine, it can be usually treated as a case of post-partum hæmorrhage. In such cases, if the laceration is incomplete, the utero-vaginal cavity must be firmly tamponned with iodoform gauze, a binder and pad applied externally, and ergot administered freely. Care must be taken when introducing the gauze not to increase the size of the rent. If the laceration is complete, in addition to tamponing the cavity it is well to plug also the rent itself, in such a manner as to exert pressure upon the torn surfaces and thus directly to control the hæmorrhage. In such cases, the patient must be most closely watched in order to detect at once the occurrence of intra-peritoneal hæmorrhage. The plugs are to be removed in twenty-four hours, and replaced if there is any further hæmorrhage. If, however, the hæmorrhage is intra-peritoneal, the case is more serious. Under such circumstances, there is no alternative save to open the abdomen and either suture the rent, if possible, or perform hysterectomy.

In cases complicated by laceration of the bladder wall and consequent extravasation of urine, the only hope of saving the patient lies in immediately opening the abdomen and suturing the wound in the bladder. The uterine tear is then sutured, or the uterus removed, according to the nature and position of the tear.

In cases complicated by prolapse of the intestines or omentum through the laceration, an attempt may be first made to return the prolapsed parts with the fingers introduced into the uterus. If the attempt proves successful and there is no other complication, it will be sufficient to plug the cavity with iodoform gauze. If the intestines cannot be returned in this manner, the abdomen must be opened and the prolapsed part drawn up from above. The laceration is then sutured or the uterus removed, as may be necessary.

Where a laceration occurs in a case in which there is pre-existing infection of the uterine cavity, the condition is most serious. In such a case, infection of the peritoneal cavity is certain to have occurred, and it is probably best to commence by considering the case as one of general septic peritonitis. Under such circumstances, the abdomen should be opened, complete hysterectomy performed, and the peritoneal cavity drained by gauze into the vagina. It is probable that thorough flushing out of the peritoneal cavity with saline solution will be of value. In such cases, the prognosis depends upon the nature of the infection. If it is of a virulent character, it is doubtful if anything can save the patient. If it is of a mild form, she may be able to resist it. As it is impossible to tell beforehand what the character of the the infection may be, the case should be always considered as amenable to treatment.

The foregoing may be considered to be an unwise attempt to lay down too definite lines of treatment. If, however, an effort is to be made to treat uterine rupture with success, we must have some definite plan which will furnish us with the broad principles of treatment. If we have such a plan, we shall be able to vary it to suit the ever-varying complications present, but without it we shall come to the treatment of a particular case with a mind as confused as the conditions present are complicated.

Prognosis.—The results of different modes of treatment can be ascertained in a general way from statistics, but the value of the latter is diminished owing to the difficulty of learning the complications and conditions under which each case was treated. Thus, we can ascertain the mortality of cases in which hysterectomy was performed or drainage adopted, but it is difficult to compare the relative value of the two in any particular case, as the cases in which they were adopted and on which the statistics are based probably differed considerably from one another.

Merz[*] collected the results of 230 cases of uterine rupture which have occurred since 1870, and tabulated them as follows:—

MODE OF TREATMENT.	COMPLETE RUPTURE.				INCOMPLETE RUPTURE.			[illegible]
	No. of Cases.	Lived.	Percentage.		No. of Cases.	Lived.	Percentage.	
Without special treatment	74	12	17·5		23	6	26·08	3
Plugging	15	6	40		10	3	30	-
Drainage	27	18	66·6		7	6	83·3	
Laparotomy with suture	24	10	41·7	48·1	—	—	—	
Laparotomy without suture	15	8	53·3		—	—	—	
Laparotomy (Porro)	15	8	53·3		1	1	100	
Treatment not stated	11	1	—		5	—	—	
Total	181	63	34·8		46	16	41·3	3

Putting on one side the relative value of the different modes of treatment as shown by this table, we see that complete rupture was attended by a mortality of 65·2 per cent., and incomplete rupture by a mortality of 58·7 per cent. The statistics compiled by Klein of Dresden, and based on an analysis of 381 cases, show that the period which elapsed between the occurrence of rupture and operation was of considerably greater importance than the particular form of treatment adopted. According to his statistics, the total mortality after operation was 44 per cent.; and after drainage, tamponing, or douching, 39 per cent. On the other hand, amongst cases operated upon at home or in Hospital within two hours of the occurrence of rupture, the mortality was 30 per cent., after an interval of from two to twelve hours, 48 per cent.; and after twelve hours, 72 per cent.

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[*] 'Zur Behandlung der Uterusruptur,' *Archiv f. Gynäk.*, Bd. xlv., Heft 2.

LACERATIONS OF THE CERVIX

Lacerations of the infra-vaginal portion of the uterus, that is, of the cervix, are of relatively common occurrence. They do not, as a rule, cause any immediate symptoms, and, consequently, often pass unnoticed. Sometimes, however, they give rise to hæmorrhage and call for treatment, but such cases are rare.

Degrees.—Clinically three degrees of cervical laceration are met with:—

(1) Laceration of the first degree which only involves the vaginal portion of the cervix, and which does not give rise to any immediate symptoms.

(2) Laceration of the second degree which extends sufficiently high above the vaginal attachment to involve the cervical arteries, and that hence causes hæmorrhage.

(3) Laceration of the third degree which extends through the cervix and vaginal vault into the peritoneal cavity.

Ætiology.—The cause of cervical laceration is the too rapid passage of the fœtus through an imperfectly dilated uterine orifice, and, consequently, anything that tends to accelerate the birth of the fœtus, or that interferes with dilatation of the cervix, predisposes to the occurrence of lacerations. The too rapid expulsion of the fœtus may be caused by unduly strong contractions, or by too energetic traction with the forceps; while imperfect dilatation of the uterine orifice may be due to extraction during the first stage of labour, to any of the conditions that cause stenosis of the cervix, or to spasmodic contraction of the cervix. The nipping of the anterior lip of the cervix, to which reference has been already made, is also a cause of cervical laceration.

Symptoms.—The first degree of cervical laceration rarely causes any symptoms. Occasionally, it may involve a vessel that is larger than usual, and hæmorrhage result. The second degree of laceration usually gives rise to hæmorrhage, but here again exceptions may occur. Laceration of the third degree usually gives rise to hæmorrhage, and, if extensive, may allow the descent of a portion of intestine or omentum through the tear into the vagina. As a rule, in these cases the rent extends through the posterior fornix into Douglas' pouch. Sometimes, it involves the lateral fornices, in which case the uterine arteries may be torn.

Diagnosis.—As has been mentioned, cervical laceration will escape notice unless it gives rise to hæmorrhage, or unless a vaginal examination is made, for some other reason, as a retained placenta, and the condition discovered. If hæmorrhage occurs from a laceration, it is termed traumatic hæmorrhage, and the method of distinguishing it from atonic hæmorrhage has been already discussed.* The existence of a laceration extending into the peritoneal cavity is ascertained by making a careful examination.

Treatment.—Laceration of the cervix of the first or second degree that causes hæmorrhage must be sutured. The method of doing so will be described later.† Laceration of the third degree extending into the peritoneal cavity must be treated on the same lines as is uterine rupture.

LACERATIONS OF THE VAGINA, PERINÆUM, AND VULVA

Lacerations of the vagina, vulva, or perinæum are the most common injuries which occur to the genital tract as a result of labour. Frequently, they are associated, and almost every laceration of the perinæum that requires suturing is accompanied by a corresponding tear of the vagina. Vaginal lacerations, however, may occur quite independently of perinæal lacerations, and vulvar laceration may occur independently of either. Consequently, we shall discuss the three kinds separately.

Laceration of the Vagina.—Traumata of the vagina may occur in two distinct forms. Most commonly, they occur as lacerated wounds due to the overstretching of the mucous membrane, and extending a varying distance into the peri-vagina structures. More rarely, they occur as fistulous openings, the result of long-continued compression of the parts between the head and the bony pelvis. In these cases, the compressio causes necrosis of the tissues, sloughing usually occurs, the piece of necrosed tissue comes away, and an opening is left betwee the vagina and a neighbouring organ, or leading into the surrounding connective tissue.

Symptoms.—The symptoms of lacerations of the vaginal mucou membrane are usually slight. If a bloodvessel is involved, ther will be a varying degree of traumatic hæmorrhage according t the size of the vessel, but, as a rule, there is little hæmorrhag Wounds, the result of long-continued compression, if they ar infected and slough, will give rise to a putrid discharge, whic comes on from two to five days after delivery, and is associate with a rise of temperature. On inspection, they appear as gre sloughing areas. If they are situated on the anterior or posteri vaginal wall, the bladder or rectum may be involved and a vesic vaginal or recto-vaginal fistula result, while, if they are near th vaginal vault, the ureter may be opened and a uretero-vagin fistula form. Vesico- or uretero-vaginal fistulæ cause incontinen of urine, recto-vaginal fistulæ incontinence of fæces and flatus.

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* *Vide* Part VII., Chap. IX., p. 860.

† *Vide* Part IX., Chap. I

Diagnosis.—The lower part of the vagina in the region of the perinæum should always be examined after delivery to ascertain if laceration has occurred. The existence of lacerations of the upper part of the vagina will only be detected if the occurrence of hæmorrhage or retention of the placenta leads us to make a vaginal examination. Later on, the appearance of symptoms of sapræmic infection associated with a putrid discharge, or the involuntary escape of urine, may lead to the discovery of hitherto unnoticed lacerations or necrosed areas. If slight bleeding precedes the birth of the head, it will usually be found to come from a vaginal laceration.

Treatment.—Vaginal lacerations, which are recognised immediately after delivery, should be sutured, as in the case of a lacerated perinæum, with the object of preventing infection of the wound surface. If, however, they are not discovered until infection has occurred, the treatment consists in careful vaginal douching, and the application of iodoform dusted on in the form of powder or introduced into the vagina as bougies or on iodoform gauze. The treatment of fistulæ belongs to the domain of gynæcology and will not be here discussed.

LACERATIONS OF THE PERINÆUM.—Lacerations of the perinæum are of more frequent occurrence and of greater importance than simple vaginal lacerations.

Degrees.—We shall divide lacerations of the perinæum into two groups according to their degree:—

(1) Incomplete laceration, in which the laceration is limited to the perinæal body and does not extend into the rectum.*

(2) Complete laceration, in which the laceration extends through the perinæal body into the rectum.

Either of these groups may be 'superficial' or deep, according as they only involve the perinæal skin and superficial perinæal fascia, or extend more deeply in the direction of the deep perinæal fascia.

In another classification of perinæal lacerations three degrees are recognised:—A first degree where the tear involves only the anterior half of the perinæum; a second degree in which the laceration extends through the perinæal body as far as the external sphincter, but does not involve that muscle; and a third degree in which the laceration extends through the sphincter and the rectal wall. As, however, the first degree is of no practical importance, this classification differs little from the former.

The depth of the laceration, *i.e.*, the distance it extends *upwards*, varies considerably. In some cases, the tear involves little more than the skin and the immediately subjacent tissues. In other cases, it extends more deeply, and, in addition to involving the skin, the vaginal mucous membrane is also torn for a considerable distance. In other cases, again, the skin may be but very slightly involved, while the vaginal mucous membrane and the deeper parts of the perinæal body are extensively torn. The vaginal tear is seldom median, but as a rule is situated to one side of the median raphé, or may involve both sides.

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* *Vide* illustrations in Part IX., Chap. I.

A curious form of laceration, which sometimes occurs, is that known as central rupture of the perinæum. In this, the laceration involves neither the posterior commissure nor the rectal wall, and is of the nature of a button-holing of the perinæal body. If the vulvar orifice is very small the entire fœtus may pass through the opening thus made.*

Ætiology.—The cause of perinæal laceration is the overdistension of the parts during the expulsion of the fœtus. Lacerations usually occur during the expulsion of the head, but may also occur during the birth of the shoulders. They are rarely met with in multiparæ, but may occur during the birth of an unusually large fœtus.

Symptoms.—The immediate symptoms caused by a perinæal rupture are slight, as it is very rare for a vessel to be involved which is large enough to cause hæmorrhage. The late symptoms, *i.e.*, the symptoms that appear during the puerperium, may be more marked. If the laceration is complete, incontinence of fæces and flatus results as soon as a purgative is administered. If the torn surfaces become infected, puerperal ulcers form just as in the case of the sloughing of a vaginal tear, and these give rise to a sanious discharge and the usual symptoms of sapræmic intoxication. The remote symptoms, that is, those coming on weeks or months after, are consequent upon the weakening of the pelvic floor, and the vaginal gaping which results from the shortening of the perinæum. The most serious consequence of perinæal lacerations is the weakening of the pelvic floor, and the resultant tendency to prolapse of the uterus. This weakening is due to the tearing across of one or both sides of the levator ani muscle, which, as we have already seen, is one of the principal structures in the pelvic floor. It is not too much to say that one of the most important factors in the causation of gynæcological complaints is a neglected laceration of the perinæum and levator ani muscle.

Diagnosis.—The diagnosis of perinæal laceration is readily made by inspection of the parts immediately after the fœtus is born. The obstetrician gently separates the labia with aseptic fingers and wipes away any blood that may obscure his view. The perinæum is then seen, and any lacerations are at once visible. To determine how far a laceration extends up the vagina, the finger must be introduced, and then the gap in the smooth vaginal mucous membrane will be readily detected. It is surprising how frequently in the past medical men have stated that they have never met with lacerations of the perinæum in their practice, and invariably in such cases they also confess that they have never looked for them. It cannot be too clearly stated that perinæal lacerations very frequently occur in primiparæ, and occasionally in multiparæ. If the patient is confined in the usual lateral position, and the buttocks are uncovered—as should invariably be done—during the expulsion of the fœtus, the occurrence of the laceration can usually be seen. Sometimes, however, especially when the laceration occurs during the expulsion of the shoulders, its occurrence may not be detected during birth, and consequently in *all* cases a visual examination of the parts must be made after the birth of the fœtus.

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* For a bibliography of such cases, *vide* Spiegelberg's 'Midwifery,' New Sydenham Society's edition, vol. ii., p. 309.

Treatment.—The treatment of laceration of the perinæum may be summed up in the words of Spiegelberg[*] :—'*Every tear*, even the smallest, ***should be sewn up***, partly because the proceeding is simple and but little painful, partly because spontaneous union is almost always imperfect, while, on the other hand, the perinæum can never form a proper pelvic floor unless it regain its original form.' Small tears should be sutured, as, if they are left to granulate, they may form the seats of puerperal ulcers; while large tears predispose to prolapse. The method of suturing will be discussed subsequently. The operation in the case of superficial and incomplete lacerations is best performed immediately after the fœtus is expelled. At this time, the patient is still partly under the influence of an anæsthetic—if one has been administered during labour, and, even if she has not been anæsthetised, the bruising which the parts have undergone render them comparatively insensitive. If, however, we are dealing with deep or complete lacerations, in which two or three different sets of sutures may be required—according as the vaginal and rectal mucous membrane are implicated, an anæsthetic must usually be given to the surgical degree after the expulsion of the placenta, and the lacerations sutured. There is, of course, some slight risk in suturing the perinæum even in superficial laceration prior to the expulsion of the placenta, as in some cases the manual removal of the latter may be necessary, a proceeding which might necessitate the removal and re-introduction of the sutures, lest they should be torn out. This risk is not, however, of sufficient importance to deter us from suturing the perinæum prior to the expulsion of the placenta, as the advantages of so doing more than counterbalance it. The manual removal of the placenta is very rarely required in primiparæ, and it is in their case that lacerations most usually occur. Further, even if it is required, the removal of the sutures is accomplished in a moment, and the pain of re-introduction is no greater than if their introduction had been postponed until after placental expulsion.

Lacerations of the Vulva.—Lacerations of the vulva, other than those occurring in the neighbourhood of the perinæum, are extremely rare, and when they do occur are usually of no importance. In some cases, however, lacerations may be found in the neighbourhood of the clitoris, and may involve the plexus of veins that surround that part, and in these cases profuse traumatic hæmorrhage may result. The diagnosis of such cases has been discussed under the head of post-partum hæmorrhage.

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[*] *Op. cit.*, vol. ii., p. 311.

Treatment.—Lacerations about the clitoris, if deep, or if causing hæmorrhage, must be sutured, as has been described when discussing traumatic post-partum hæmorrhage.

RUPTURE OF THE PELVIC ARTICULATIONS

Rupture of the pelvic articulations is a very rare accident. It most usually occurs at the symphysis, and is due to the forcible separation of the pubic bones. It is always associated with over-straining or separation of one sacro iliac articulation, as the rigid pelvic ring will only open up if two points at least on its circumference are loosened (Spiegelberg[*]). According to the same author, the symphysis and the right sacro-iliac joint are most usually torn, next the symphysis and the left sacro-iliac joint, then all three joints, and most rarely of all the two sacro-iliac joints alone.

Ætiology.—The predisposing causes of rupture are to be found in previous inflammation or relaxation of the joint. In such cases, a very small degree of pressure may cause rupture. Ahlfeld[†] records a case in which the pelvic articulations ruptured during labour, although the fœtus was expelled within an unruptured bag of membranes—a fact which showed that the intra-uterine pressure could not have been excessive. In cases in which there is no apparent antecedent disease, rupture may be due to disproportion between the head and the pelvis, associated with strong uterine action. It may also occur from too forcible attempts at extraction with the forceps, in cases in which the head is too large to pass through the pelvis. Rupture is most common in cases of generally contracted pelvis, owing to the forcible thrusting apart of the innominate bones at each end of the narrowed transverse diameter. Rupture is also common in osteomalacic pelves, as, in them, transverse contraction is associated with softening of the joints.

Diagnosis.—The patient may in some cases give a definite history of having heard and felt the joint rupture. Then, on palpation, the ruptured joint is found to be painful and tender, and the patient is unable to move the legs, which are rotated outwards on the hip-joints (Ahlfeld). In rupture of the symphysis, pain can also be elicited by pressure on its posterior surface with the finger in the vagina. In rupture of the sacro-iliac joint, pain is elicited by gently pressing together the crests of the ilia.

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[*] *Op. cit.*, vol. ii., p. 322.

[†] 'Die Verletzungen der Beckengelenke,' etc. Schmidt's *Jahrbuch*, Bd. clxix, 1876.

Treatment.—The treatment is identical with that of cases in which symphysiotomy has been performed. The patient must remain in the horizontal position, with the pelvic bones maintained in their proper position by means of a binder, until such time as union has been obtained, and even after she is able to walk the binder must be continued for at least a year.

INVERSION OF THE UTERUS

When the form of the uterus is so altered that the inner surface of the organ is turned outwards and the outer surface is turned inwards, the uterus is said to be inverted. This form of uterine displacement is met with either as an acute inversion occurring immediately after delivery, or as a chronic inversion. Here, we are alone concerned with the acute form.

Frequency.—Inversion of the puerperal uterus is a rare accident. Churchill stated that it had occurred only once in 190,000 deliveries in the Rotunda Hospital, but we doubt that this is even an approximately correct proportion. We have ourselves met with one case in the Extern Department of the Rotunda Hospital, and Purefoy showed before the British Gynæcological Society other cases which had occurred during his Mastership.

Degrees.—Schultze describes three degrees of inversion. They are as follows:—

(1) The first degree comprises those cases in which the inverted fundus lies at or above the os externum. This degree, which is the initial stage of all inversions, is rarely permanent, as it tends either to become reduced, or else to continue and pass into one of the succeeding degrees.

(2) The second degree includes those cases in which the fundus has passed lower down, and in which more or less of the inverted uterus lies below the external os. It is the degree in which chronic inversion is most usually met.

(3) The third degree comprises those cases in which the entire uterus, including the cervix, has become inverted. It is very rarely met with in cases of chronic inversion, but an acute inversion is probably usually found in this condition.

Etiology.—Three conditions must be associated in order to permit of the occurrence of either the second or third degree of inversion (Schultze). These are:—Enlargement of the cavity of the uterus; relaxation of part of its wall; and a cervix which is sufficiently dilated, or capable of being sufficiently dilated, to allow the passage of the body of the uterus. All these conditions are fulfilled after delivery in those cases in which the uterus does not contract well. With these conditions present, if the intra-uterine pressure becomes less than the intra-abdominal pressure the fundus dimples in, and, if this relation between the two pressures is continued, inversion goes on until it has become complete. Accordingly, all factors which cause such a relation between the two pressures may be regarded as the exciting causes of inversion. The more important of these are:—

(1) Dragging upon the placental site, in the case of a fundal insertion of the placenta, by pulling upon the cord while the placenta is still adherent.

(2) Violent straining associated with sudden emptying of the uterus, as:—precipitate labour; or severe straining and pressure, in the removal of the placenta, while the uterus is in a relaxed condition (Winckel).

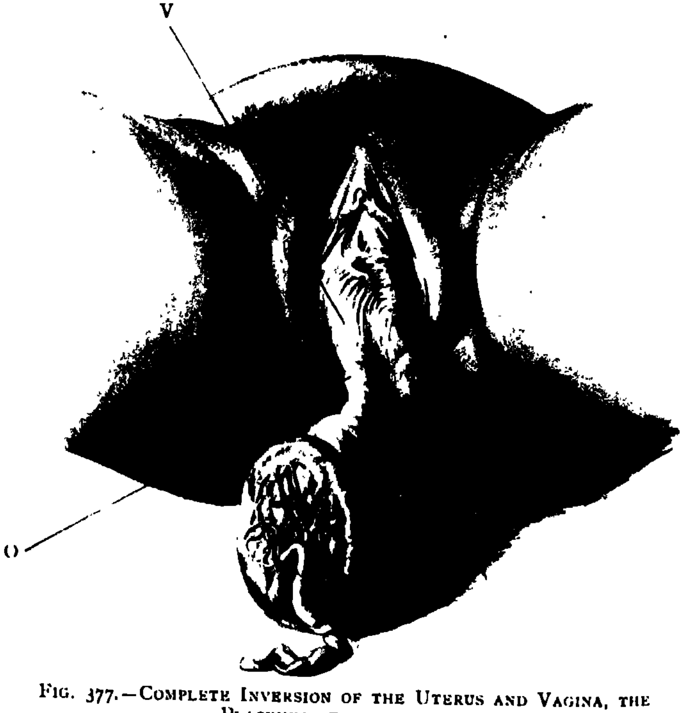

FIG. 377.—COMPLETE INVERSION OF THE UTERUS AND VAGINA, THE PLACENTA STILL ADHERENT.

V, Vagina; O, uterine orifice. (Bumm.)

Symptoms.—The occurrence of acute inversion is usually marked by the collapse of the patient, a collapse which may come on either immediately after inversion occurs, or more rarely after a few hours. If the placenta has been separated in part or altogether, there will also be severe hæmorrhage.

Diagnosis.—If the hand is placed upon the abdominal wall, the absence of the fundus of the uterus from its usual position will be readily determined. If a careful bi-manual examination is made, it may be possible to determine the existence of a cup-shaped depression corresponding more or less exactly to the former position of the cervical canal. At the same time, the vagina is found to be occupied by a globular tumour to which the placenta may or may not be attached, or in extreme cases the vagina may be also partially or completely inverted, and so the inverted uterus may lie in part or altogether outside the vulva. The diagnosis is then at once obvious. If the inversion is only partial, a cup-shaped depression will be felt in the centre of the uterus.

Treatment.—The treatment consists in the detachment of the placenta, the replacement of the uterus, and the adoption of measures calculated to keep the latter in its normal position.

There is nothing special to be said regarding the removal of the placenta, and it is carried out in the ordinary manner, the greatest care being taken to ensure asepsis. The replacement of the uterus in acute cases is not usually a very difficult matter. The uterus is grasped in the hand, and pushed gently upwards, endeavouring to return first the part that came down last. If the size of the uterus prevents its reduction, it is possible that the proceeding would be facilitated by producing a temporary partial anæmia of the uterus by the application of adrenalin, and so a temporary reduction in the size of the uterus. At any rate, adrenalin might be tried, as, if used in a sterile condition, it could cause no harm and might prove of value.

As soon as the uterus has been replaced, it is douched out thoroughly, and plugged firmly with iodoform gauze with the object of preventing the recurrence of the displacement.

Prognosis.—An acute inversion, if left untreated, is frequently fatal. If the patient survives, it passes into the chronic stage. If the condition is recognised, and treated before the patient has lost an excessive quantity of blood and before the uterine cavity has become infected, the prognosis is fairly good.

PART VIII

PATHOLOGY OF THE PUERPERIUM

CHAPTER I

THE SURGICAL FEVERS OF CHILDBED

Introduction—Nomenclature—Ætiology; The Infecting Organisms; Predisposing Causes—Sapræmia—Local Septic Infection—General Septic Infection; Lymphatic Sepsis; Pyæmia.

THERE is no question as to the supreme importance to the obstetrician of the group of diseases formerly known as 'Puerperal Fever,' and still written of in Germany as 'Kindbettfieber'—the fever of childbed. Records of puerperal mortality and morbidity still demonstrate clearly enough how little removed from being pathological are such physiological crises as labour and childbed. A little more than twenty years ago Winckel, basing his conclusions on 717,000 hospital and 362,000 private cases, could affirm that the mortality from all causes averaged 3 per cent. in the former and 0·6 to 0·7 per cent. in the latter, and the greater part of this mortality must be credited to puerperal fever. These statistics belonged, of course, to the pre-antiseptic period; and, if the statistics of to-day no longer cast so deep a shadow on the usefulness of our art, they suffice to show how far we still are from the attainment of the obstetric ideal—a truly physiological labour.

In a recent text-book, Bumm of Halle begins his lecture on 'Kindbettfieber' by the statement:—'The pathology of childbed is dominated by puerperal fever. Only the fourth part of the women who die as a result of labour do so in consequence of such special complications as eclampsia, ruptured uterus, hæmorrhage, embolism, or of such accidental diseases as occasionally attack a woman during childbed. Three-fourths of the mortality is due to puerperal fever.' This, be it noticed, is the opinion of an expert, in a country where many causes combine to make statistics of more value than they are among us. Yet our own statistics suffice to teach us important lessons. Byers, of Belfast, has collected some useful statistics in relation to present-day puerperal mortality in Ireland, which show that, among 7,603 patients of the Rotunda Lying-in Hospital during the two years ending November 1, 1903, there were eight deaths from sepsis—representing a mortality of 0·1 per cent. On the other hand, the general, as distinguished from hospital, mortality from the same cause is given as 0·233 per cent. in 1900, 0·228 in 1901, 0·216 in 1902, and 0·231 in 1903.* Here, then, we have a very striking contrast with the state of things as indicated by Winckel's statistics. First, we note the marked improvement in both classes of cases, an improvement most marked among hospital patients; and, secondly, we note that the puerperal mortality, arising from the causes we are discussing, is now distinctly less in well-managed hospitals than that occurring in connection with privately conducted labour cases, and this despite the *primâ facie* disadvantages and risks attending the accumulation of patients in a hospital used for clinical instruction.

How far habitual expert pathological opinion upon fatal cases might tend to increase the percentages as here presented to us is an open question. It seems probable to the writer that—to a much greater extent here than in Germany—such statistics must be regarded as giving as favourable a return as circumstances permit, especially in the case of the non-hospital statistics. It must be considered that twenty-five years ago, at a time not far removed from that of Meigs in America, who attributed these diseases to the action of 'chance or Providence,' and when authorities of our own, following Fordyce Barker, regarded them as effects of 'epidemic constitution,' there was no such reason as undoubtedly exists at present for avoiding in death certificates the use of a term which is apt to convey a suggestion of personal responsibility.

Nomenclature.—In the foregoing paragraphs the old term 'puerperal fever,' by which the diseases here treated of were once universally known, has been used. It is, however, an example of a very inadequate nomenclature, suggesting, in one sense, the existence of a specific fever essential to childbed; or in another, the simple fact of fever, whatever its kind, existing during this period; while, in a third sense, the term has been limited in its use to the graver and more fatal forms of fever which may arise during childbed. For adhering to its first, and, from a verbal point of view, only legitimate sense, there never were sufficient grounds, while the progress of bacteriological knowledge has rendered it entirely untenable. Individual cases vary so greatly in symptoms, signs, and microscopic and macroscopic pathology, that it is no longer possible to allege the existence of any fever essentially connected with the puerperal state. In the second sense, it might, perhaps, be replaced by the term 'puerperal fevers,' as has been done by Galabin, if it were not that scientific nomenclature demands, where possible, that we should prefer the use of some term or terms which would serve the purpose of informing us as to the true nature of the disease. In the third sense is contained an assumption, entirely unsupported by evidence, that there is a fundamental difference in kind between such fevers as are dangerous and such as are not.

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* *Vide* also Part IV., Chap. II., p. 296.

Despite, then, the advantages of retaining a familiar term, it seems advisable to abandon it as not only defective, but misleading. An accurate and scientific nomenclature can arise only in the light of precise and adequate knowledge. In attempting to frame such upon a pathological basis, it is before all else essential that the terms adopted should possess these requisites of precision and adequacy. Such words as 'sepsis,' 'septic,' 'infection,' etc., must, if employed at all, be employed in strict conformity with established pathological usage.

The main current of recent authoritative opinion favours the use of the terms 'puerperal septicæmia' or 'septic infection.' To both there is the sufficient objection that, even on the showing of those who use them, they fail, if correctly applied, to cover the ground. Putrid intoxication, perhaps the most common form of puerperal fever, cannot properly be ranked either as a septicæmia or as a septic infection. The distinction between the two conditions is equally marked, whether considered from a clinical or a pathological standpoint.

Both conditions owe their origin to the activities of micro-organisms, and both are toxæmias; but in the case of the first—putrid intoxication or sapræmia, as it was called by Matthews Duncan—the micro-organisms are saprophytes, which do not and cannot invade living tissues, but are able, by their decomposing action on dead tissues along the track of the genital canal, to manufacture poisons locally, the systemic absorption of which is the main cause of symptoms; while in that of the second—septic infection—the micro-organisms are parasites, which invade living tissues, multiply within them, and within them manufacture by their metabolism those toxins the various effects of which are seen in the gravest of all puerperal diseases.*

In both conditions, therefore, there are two features in common, a bacterial origin and a resulting toxæmia, and so the term 'puerperal toxæmias' might be correctly adopted as sufficiently inclusive. It fails, however, to indicate with precision those cases in which the pathological changes are almost entirely local, such as cases of puerperal ulcer or local abscess. In these, indeed, a toxæmia is present, but it would be pedantic to assign that term as a description, since its importance is but slight in comparison with the local lesions. Again, the term 'toxæmia' is insufficient as a description of those infections where not merely the bacterial toxins, but the bacteria themselves, circulate in the blood-stream.

We have decided, then, to adopt the title 'The Surgical

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* The foregoing paragraphs are from the hand of the late Dr W. C. Neville, to whom this chapter had been first entrusted. His early death has prevented the completion of a task for which he was singularly fitted by his large clinical experience and his sound pathological knowledge.

Fevers of Childbed' as most simple, most accurate, and least open to objection. It is true the term 'fever' indicates a symptom rather than a pathological condition, but it is a symptom which is common to all these cases, and which is usually the first to attract attention. The limitation expressed by the term 'surgical' is of value, as it excludes infections of the exanthemata, such as scarlatina, occurring in the puerperium; and, further, it serves to emphasize the fact that the fevers of the puerperium are in no wise specifically distinct from those originating from surgical causes at other periods of life.

Ætiology.—So far, we have assumed that the fevers of which we treat are bacterial in origin. This assumption at the present day is amply justified by proof, but we must remember that, at no distant period, very different views were held as to their ætiology.

Up to the beginning of the eighteenth century, the doctrine which was most generally held was that puerperal fever was a result of the suppression or retention of the lochia. To this belief Hippocrates, Galen, Avicenna, Albucasis, Paré, Petit, Willis, Sydenham, Boërhaave, and many others, subscribed, some regarding suppression of the lochia as the only, others as the principal, cause of the disease. In the eighteenth century, Ludwig, Smellie, and Home, among others, expressed similar opinions. This traditional belief, which held sway for so long, is hard to explain, for disappearance of the lochia is, as we shall see, by no means a common feature of the disease. It is true that in very acute cases the lochia disappear, but, before this occurs, the fever has already declared itself; while, on the other hand, many cases of puerperal infection are accompanied by an increase in the quantity of the lochia.

Side by side, however, with the doctrine of suppression of the lochia, there grew up, from the middle of the seventeenth century onwards, a belief in the efficiency of 'milky metastasis' as a cause of puerperal fever, and this belief is still held to some extent by the general public, as the persistence of the terms 'milk fever' and 'milk leg' testifies. Writing in 1870, Hervieux* asks:—'How many women, even of the better class, do we not see who refer puerperal accidents, or their consequences, to the milk gone wrong' (*lait répandu*)?

During the eighteenth century, most writers on obstetrical subjects mention milky metastasis as, at any rate, one of the causes of puerperal fever, while many of them regard it as the principal or sole cause. The doctrine generally put forward was that an excess of milk was formed: according to some in the blood, to others in the breasts, and that this milk, instead of being discharged by the breasts, found its way to the generative organs, or other abnormal situations, giving rise to a pathological condition. Thus, in a memoir on the epidemic of puerperal fever which occurred in Paris in 1746, De Jussieu and his colleagues mention* that in *post mortem* examinations they discovered a 'milky serosity' in the cavity of the pelvis, and 'clotted milk' on the surface of the intestines. In 1769, Bouté similarly points to the occurrence of 'milky or puriform lochia' in certain cases.† A few years later, Leroy identifies abscesses with collections of milk,‡ and other writers fall into the same error. Towards the end of the century, however, this view began to be questioned, and finally it received its death-blow from Bichat, who in 1801 explained the lesions observed in the peritoneum as due to inflammation, and demonstrated their occurrence in men and in non-lactating women.§ Curiously enough, Dease of Dublin, writing twenty years earlier, had mentioned finding in the abdominal cavities of males, dead after operation for the stone, similar appearances to those observed in puerperal fever, but he failed to realise the full significance of his observation.‖

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* 'Traité des Maladies Puerpérales,' p. 6.

While the milk doctrine was the more fashionable one on the Continent, an alternative belief, and one better grounded, was obtaining more and more support in England. This was the theory of a specific puerperal fever. This theory was not in all cases independent of the two we have previously mentioned, for while some regarded the fever as due to putrid absorption of retained lochia, others brought it into relation to milky metastasis. Some writers, such as Willis,¶ definitely distinguished putrid fever from milk fever, and he mentioned as a third class, putrid fever complicated by pleurisy, small-pox, and other secondary conditions. The many epidemics of puerperal fever which visited great cities and maternities during the eighteenth century, such as those at Paris in 1746, at Rotterdam in 1766, at London in 1770, at Vienna in 1771, and at Edinburgh in 1775, naturally strengthened the belief in the specific nature of the disease, but it was not until long afterwards that epidemics were explained on the principle of contagion.

Nevertheless, during this period, from time to time writers put forward accounts of the incidence of the disease which could not be explained on any other principle than that of infection. Thus, in 1795, Gordon, noticing the morbidity attending his own practice, confesses:—'It is a disagreeable declaration for me to make, that I myself was the means of carrying the infection to a great number.

From this time on to the middle of the nineteenth century, the doctrine of an infective puerperal fever as a clinical entity gradually gained ground. Nevertheless, many observers both then and in the previous century emphasised the local nature of some cases of puerperal fever, and while some considered inflammation of the uterus the essential lesion, others regarded inflammation of the peritoneum as more important. Towards the end of the eighteenth century, too, it was maintained by many, of whom Kirkland is perhaps the most notable, that under the term 'puerperal fever' many distinct conditions or diseases are to be included.

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* A. de Jussieu, Col de Villars et Fontaine, 'Mémoires de l'Académie royale des Sciences.' Paris, 1746.

† *Journal de Médecine*, vol. xxx., pp. 27 and 112. Paris, 1769.

‡ 'Mélange de Médecine et de Physique,' p. 198.

§ 'Anatomie Générale,' vol. iii.

‖ 'Observations in Midwifery,' p. 113. Dublin, 1783.

¶ 'Opera Medica et Physica,' Bk. xvi., 1676.

During the first half of the nineteenth century, there does not seem to have been any very marked effort made to solve the problem of the childbed fevers in a scientific manner, and many of the most skilful obstetricians refused to make any scientific hypothesis as to the causation of the disease, preferring to regard it, as Meigs put it, 'as due to the workings of Providence.' During this period, too, the hypothesis of miasmic origin was first brought forward, a hypothesis whose later developments may be traced in the more modern doctrine of air infection.

A definite step in advance was made, however, in 1843, when Oliver Wendell Holmes published, in an essay entitled 'The Contagiousness of Puerperal Fever,' his reasons for believing that puerperal fever was carried to the patient by the accoucheur or the nurse, and that, therefore, it was preventable. His teaching met with the most bitter opposition, and called forth from Meigs, one of the leading obstetricians of the day, the remark we have quoted above.

While Holmes was persisting in the promulgation of his views in America, Semmelweiss,* assistant in the maternity at Vienna, noticed that the mortality among women attended by students during confinement was three times greater than that in the wards where only midwives were in attendance. While searching diligently for the cause of this striking difference, one of his colleagues died of pyæmia, the result of a dissecting-wound. By a flash of genius, the matter became clear to Semmelweiss, and he was soon able to announce that puerperal fever was an infection carried to the uterus in the form of a cadaveric poison on the hands of the students, who came fresh from the dissecting-room to the lying-in wards. By the simple device of insisting on the students cleansing their hands in chloride of lime, he was able to reduce the mortality in the lying-in wards to less than one per cent.

There is no need to trace further the history of the study of puerperal infection. The only correction needed in Semmelweiss' pronouncement, to bring it into line with modern views, is to substitute 'bacillary virus' for 'cadaveric poison.' This development has been made by the researches of Pasteur and Lister, and the identity of puerperal fever with one or other of the forms of surgical infection is now undoubted. The conditions necessary to establish a causal relation between an organism and a disease—the constant association of the organism with the disease; its separation and growth in pure culture outside the body; and the production, by inoculation of animals with the organism, of lesions similar to those characteristic of the disease—have been fulfilled many times in the case of the puerperal infections.

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* *Wiener Zeitschrift*, December, 1857; 'Die Ætiologie, der Begriff, und die Prophylaxis des Kindbettfiebers.' Vienna, 1861.

Parasitic Organisms.—The bacterial origin of the fevers of childbed being established, the next point is to study the nature of the invading organisms. They are similar to those found in other forms of surgical infection, and, if for the present we exclude the putrefactive organisms which are the causes of sapræmic intoxication, we shall find that the organisms most commonly present in childbed fevers are *streptococcus pyogenes*, *staphylococcus pyogenes* and *bacillus coli*, and that others occasionally met with are *gonococcus*, *bacillus diphtheriæ*, *bacillus tetani*, *pneumococcus*, and possibly *bacillus aërogenes capsulatus*.

Streptococcus Pyogenes.—So long ago as 1863, the occurrence of the streptococcus in cases of fever in childbed had been noted by Mayrhofer, and shortly afterwards by others, including Coze, who in 1869 found it in the blood in a fatal case. It remained, however, for Pasteur in 1879 to prove that this organism was the causal factor in several cases investigated by him. His researches have been amply borne out by many observers in the years that have since elapsed, and in the severer forms of infection the *streptococcus pyogenes* is nearly always found, either alone or in association with other organisms.

The streptococcus is widely distributed in nature, and has been found in floor-dust, in river-water, on the skin, and in the mouths of healthy individuals. Under these conditions, it possesses but a low degree of virulence. Its virulence is, indeed, very variable, and, experimentally, it can be increased to a high point by successive inoculation from animal to animal, or by alternation between inoculation of animals and culture *in vitro*. The same race of the organism can thus be made to produce effects varying in degree from a mere passing erythema to a rapidly fatal septicæmia.

The streptococcus is, therefore, found associated with conditions differing entirely in their clinical manifestations. It may cause local suppuration such as a boil or a carbuncle, or an extensive phlegmon. It is the cause of the wide-spreading dermal inflammation termed erysipelas, and of the inflammations of the blood and lymph channels known as phlebitis and lymphangitis. It is moreover frequently found in apparent symbiosis with other organisms, and, in such cases, the process has usually a greater virulence than if a single organism alone were concerned. Thus, when a diphtheritic or a tubercular infection receives a secondary implantation of streptococcus, it usually proceeds more rapidly, and greater injury to the tissues, as well as more severe toxæmia, results.

The infection of puerperal women with streptococcus derived from streptococcal lesions in other patients, has been often noted, and, in particular, the connection with erysipelas is well known. This is all the more interesting as there was for long a difference of opinion among bacteriologists on the identity of the *streptococcus pyogenes* with the *streptococcus erysipelatis* of Fehleisen. This point is now settled, and the two are believed to be identical.

Staphylococcus Pyogenes.—Shortly after Pasteur made known the connection of the streptococcus with puerperal infection, other observers drew attention to the occurrence of a staphylococcus which has since been identified with the *staphylococcus pyogenes aureus.* It has been found in the lochia, in the pus of pelvic abscesses, in peritoneal inflammations, in metastatic abscesses, and in secondary infections of the serous surfaces, such as the pleura and pericardium.

The *staphylococcus pyogenes*, of which there are three varieties, *aureus*, *albus*, and *citreus*, the first being that most concerned in puerperal infections, has an even wider distribution in nature than the streptococcus, and has, speaking generally, very similar properties. It is found practically everywhere—on the skin, on the clothes, in the dust of the floor and of the street, and it is constantly present in the mouth and upper air-passages. It must always be remembered, however, that pathogenic organisms tend to lose their virulence when living in a non-pathogenic condition, and there is, therefore, much less danger of infecting a wound by the introduction of a drop of healthy saliva than of a drop of pus, even if the number of pathogenic organisms is the same in each. Pathologically, the staphylococcus is most commonly found in association with circumscribed abscesses, particularly those in connection with the skin. It may give rise to metastatic abscesses, but it rarely causes a profound toxæmia, and it has no power to produce diffuse penetrating inflammations such as erysipelas. When it is present in such cases, it is usually in association with the streptococcus.

It has been often stated that the pathological results of a puerperal infection with staphylococcus are less severe than those due to streptococcus, but it is probable that this is a hasty generalisation, as several cases of very severe staphylococcal infection are on record.

Bacillus Coli Communis.—The *bacillus coli communis* is of more frequent occurrence than the staphylococcus. Whitridge Williams,* in an examination of 150 cases where the temperature rose to 101° F. during the first ten days of the puerperium, found the colon bacillus present in the uterine lochia in twenty cases, in eleven of which it was the only organism discovered. In fifty-four cases of puerperal fever examined by Foulerton and Bonney,† the colon bacillus was found in the uterine contents in seventeen.

The frequency of infection by the colon bacillus is easily explained by the habitual presence of that organism in the intestines under normal circumstances. The bacillus is, moreover, discharged in enormous quantities in the fæces. It has the property in certain media of producing gas, and also of forming indol, and both these actions are normally exercised in the intestine. It is probable that the colon bacillus, so long as it remains in the intestine, is harmless, though some observers have credited it with the production of certain of the summer diarrhœas, and during typhoid fever, it usually undergoes changes which increase its virulence, as shown by inoculation. When, however, the bacillus finds its way into situations other than the intestine, it is distinctly pathogenic. In infections of the peritoneum, which have spread through the intestinal wall, whether by a perforation or otherwise, the colon bacillus is the infecting organism. It is especially noted in abscesses and inflammations originating in relation to the appendix, and occasionally, but more rarely, it is responsible for secondary inflammations of the pericardium and pleura. From its constant occurrence in the fæces, it is obvious that any soiling of the skin round the anus will deposit it in that neighbourhood, and the fact that it is the most common organism met with in acute inflammations of the urinary passages, can be explained by its introduction into the bladder on catheters which have been infected by contact with these parts. The motile power possessed by the bacillus enables it to extend its area of infection.

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* 'Text-book of Obstetrics,' 1901, p. 762. † *Practitioner*, March, 1905.

The term '*bacillus coli*' should not be regarded as the name of a definite species. It is rather the common term applied to a number of types, in virtue of the possession of certain properties in common, although the different races concerned may differ in many points of detail. Closely allied to the bacteria of the colon group, if not actually to be included in it, are such organisms as the typhoid bacillus, and the various species which have been decribed as 'paratyphoid' and 'paracolon.' On account of this relationship, it is well to draw attention here to certain puerperal infections which have been reported by various observers as due to the typhoid bacillus. One apparently authentic case was observed by Whitridge Williams and Dobbin,* where the typhoid bacillus, along with other organisms, was separated from the lochia, and where the blood reacted to the agglutination test. All the usual symptoms of typhoid fever were absent. The patient had been confined on the bed where her husband had died shortly before of typhoid fever, and the reporters believed that the infection had been introduced to the genital passages on the hand of the midwife. In most, if not all, of the other reported cases, however, the presence of typhoid bacilli in the lochia was probably secondary to infection of the intestine, so that such cases are to be regarded rather as typhoid fever occurring during the puerperium than as a true puerperal infection with the typhoid bacillus. Even in Williams' and Dobbin's case this explanation is not excluded, as the woman recovered, and it was therefore, impossible to discover the condition of the intestines; while in a case reported by Blumer,* in which the clinical symptoms were very similar, an autopsy revealed the presence of typical typhoid lesions in the intestine.

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* *American Journal of Obstetrics*, August, 1898.

Gonococcus.—Out of 179 cases of puerperal infection recorded by Krönig, the gonococcus was separated in fifty; while out of 150 cases recorded by Williams, where the temperature reached 101° F., the gonococcus was present in eight. Recent writers, however,† are inclined to doubt the accuracy of these observations, and are of opinion that the organism separated in most cases, though resembling the gonococcus in certain particulars, could with care be distinguished from it. Whether it is the gonococcus or not, a diplococcus resembling it in shape is found very frequently in the uterus in infections which are unaccompanied by severe septicæmia or extensive suppuration.

Bacillus Diphtheriæ.—As is well known, true diphtheria, due to the Klebs-Löffler bacillus, occasionally occurs on the vulva, and in some instances a true diphtheritic membrane may form on the vulva and in the vagina during the puerperium. This is quite a different pathological condition from so-called 'diphtheritic endometritis,' where the causal organism is usually the streptococcus. The writer has not met with any reports of true diphtheria of the uterus.

Bacillus Tetani.—A large number of cases of tetanus occurring during childbed have been recorded by Chantemesse, Rubeska and others, and the tetanus bacillus has been found in the discharges. In most cases where this infection occurs, the confinement has taken place amid filthy surroundings, and without proper antiseptic precautions. This form of infection is said to occur more frequently after abortion than after labour at full term.

Pneumococcus.—In recent papers, Foulerton and Bonney† have drawn attention to the frequency with which they have found this organism in the uterus in cases of puerperal fever. A few other cases are on record.

Bacillus Aërogenes Capsulatus.—The gas bacillus, though described as parasitic, is probably only present as a saprophyte, in cases in which infection by some other organism has occurred. It is said to be responsible for the occurrence of the condition known as '*tympania uteri*,' and it has been pointed out by Dobbin and others that the diagnosis of 'air embolism' has probably been made in some cases where the supposed air was in reality gas formed by this organism. The presence of bubbles in the lochia may be due to this organism, to the colon bacillus, or to various sapræmic germs.

The organisms described in the foregoing paragraphs are responsible for the great majority of cases of puerperal infection. It cannot be claimed, however, that the list is exhaustive. In many cases unidentified bacilli, many of them anaërobic, have been seen, though usually they are in association with one or other of those we have described. Sometimes, however, they occur alone.

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* *American Journal of Obstetrics*, 1899, p. 42.

† *Transactions of the Obstetrical Society of London*, 1905; and *Practitioner*, March, 1905.

Putrefactive Organisms.—In the introductory paragraphs of this chapter, a distinction was made between septic and sapræmic conditions. In the preceding paragraphs, we have described the parasites responsible for the former class, and it now remains to speak of the saprophytes which cause the latter.

Putrefactive organisms differ in one important respect from the organisms that cause septicæmia, in that they are incapable of multiplying in living tissues. That is to say, they are not true parasites, and consequently we cannot speak of infection by saprophytes, but only of intoxication. The particular organisms concerned are among those that are active in ordinary putrefactive processes outside the body. They are everywhere present in nature, though their activity is greatly hindered by extreme cold. In warm weather, on the other hand, putrefactive processes become much more rapid. The varieties of such organisms are very many, and, up to the present, there has been but little attempt to classify them. Those usually found in sapræmia are anaërobic, and many of them produce gas of unpleasant odour. Bumm, Döderlein, Krönig, and others, have separated various saprophytic organisms from the lochia, but it is not necessary, nor indeed possible, to make any definite statements as to those most commonly concerned.

Although we have thus carefully distinguished sapræmia from the parasitic infections, there is considerable doubt whether it ever exists quite alone. It is quite possible that a retained piece of placenta or of membranes may undergo putrefactive decomposition in the uterus, without any infection of the uterine walls taking place, but, in the majority of cases, there is probably very little absorption of toxins, unless the uterus is attacked at the same time by a parasitic infection. Nevertheless, although theoretically a pure sapræmia may be rare, clinically the distinction between sapræmia and septicæmia is quite clear; in other words, in many cases all the symptoms of the patient point to the absorption of poisons and to local putrefaction, and not to a bacterial invasion of the tissues. Such cases are classed as sapræmia.

Predisposing Causes.—In those diseases which are due to bacterial invasion, there is always a danger of overlooking the conditions which favour the entrance into the system, or the growth, of the invading organism. These conditions are, however, of the utmost importance, as without them infection will not occur. It may be said that anything which tends to lower the vitality of the subject thereby decreases the resistance to bacterial invasion. Thus, a difficult or prolonged labour, or a labour involving operative interference and severe hæmorrhage, is more liable to be followed by infection than is a normal labour. If to these conditions are added a general condition of debility, as from overwork, bad hygienic surroundings, or wasting disease, the liability is increased. It is probable that the custom still observed by some physicians of keeping puerperal patients on unnecessarily low diet is responsible for occasionally bringing about a susceptibility to infection.

From very early times, it has been shown that, in cases where the confinement is accompanied by mental distress, puerperal infection is more likely to follow. In some cases, the distress may be merely the result of a nervous temperament, which makes the patient look forward with anxiety to her first confinement, while in others, it may be due to the disgrace attending illegitimate motherhood, accompanied by the distress of possible desertion. There is every reason to believe that such mental conditions are important predisposing causes of infection.

Slight or severe abrasions or lacerations, and, in fact, all breaches of continuity in the genital mucous membrane, offer channels for infection. Moreover, prolonged labour, by giving more opportunity for vaginal examinations, and thereby increasing the chance of infectious material being deposited in the genital passages, increases the danger. For these reasons, it is probable that primiparæ are more prone to infection than are multiparæ, as in them genital lacerations and prolonged labour are more frequent.

There is little doubt that the adoption of the recumbent position during the early days of the puerperium increases the chance of infection by preventing free drainage of the lochia from the vagina. Kinkead believes* that the comparative freedom from puerperal sepsis of country women in the West of Ireland, in spite of insanitary surroundings and attendance by septic midwives, is due to their custom of sitting up in bed almost immediately, and walking about in two or three days after delivery. As long ago as 1785, White insisted on his patients sitting up a few hours after delivery, and getting out of bed on the second day, and he believed that by this means he avoided the occurrence of puerperal fever.†

A necessary condition for saprophytic intoxication is the presence of dead material in the uterus or vagina. Such material may be provided by the retention of lochia in the genital passages, or by the retention of a portion of placenta or membrane in the uterus.

A very common predisposing cause, and one to which all parturient women are liable, is constipation. The auto-intoxication to which this condition gives rise is probably of more importance as a predisposing factor in the causation of many of the infective diseases than any one other condition that can be named.

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* *American Journal of Obstetrics*, vol. xviii., p. 8.

† 'Treatise on the Management of Pregnant and Lying-in Women,' third edition, 1785, p. 118 *et seq.*

We have already* discussed the manner in which septic and sapræmic organisms gain entrance to the genital tract, and so we need not here refer to it.

SAPRÆMIA

By the term 'sapræmia' is meant the condition of intoxication resulting from the absorption of the poisons produced by putrefactive decomposition. For the most part these poisons are of the nature of ptomaines, bodies which in their chemical characters closely resemble the vegetable alkaloids. They are, however, much less stable, and, consequently, more difficult to obtain in pure form. Extracts of some of them have been obtained, and their toxicity demonstrated by their action on animals. In the body, their toxic effect is either convulsive or narcotic, and they produce the constitutional symptoms to be presently described.

Pathological Anatomy. — In cases of retained lochia, a slight absorption of saprophytic poisons may take place without any accompanying anatomical lesion beyond a slight congestion of the mucous membrane of the vagina or uterus, due to the irritation of the tissues by the decomposing lochia. The most typical local condition, however, associated with sapræmia is an inflammation of the uterus known as *putrid endometritis.* The uterus is found to be large, soft, and flabby; its inner surface is covered with a rough, friable, and stinking slough, which easily tears away in large masses, and it is bathed in a dirty, frothy, and bloody or purulent fluid. The lochia have a similar character, and contain necrosed portions of the uterine wall of varying size. They are peculiarly ill-smelling (*v.* Fig. 383).

The microscopical character of the inflammation is also distinctive from that of other types of endometritis. The layer of necrosis is, as the gross appearance tells, much thicker than in septic endometritis. In the living tissue underlying it, there is a zone of infiltration where the leucocytes are densely crowded together. The organisms are almost completely confined to the necrotic layer, and, though a few bacilli may be seen in the more superficial parts of the layer of leucocytes, none will be found in its deeper parts or beneath it (*v.* Figs. 378, 379).

Although this form of endometrial inflammation is always associated with sapræmic symptoms, it cannot be said to be due in its entirety to saprophytic irritation. In probably every case, a careful bacteriological examination will show the presence of pathogenic germs in addition to true saprophytes. Moreover, the form of endometritis commonly due to infection with the colon bacillus, either alone or in conjunction with other parasitic germs, cannot be distinguished from that just described. It is probable that in many cases of putrid endometritis, irritation by saprophytic poisons is the first step towards an infection by septic organisms, which in their turn produce superficial necrosis of the uterine wall, and thereby supply further pabulum for the saprophytes.

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* *Vide* Part II., Chap. I.

The general pathological changes due to sapræmia can be described in a few sentences. The blood is dark in colour, coagulates imperfectly, and tends to stain the vessel walls. There is, in fact, a disintegration of the red corpuscles, showing that on them at any rate the toxins exert some influence. Small, dark extravasations of blood occur in the serous membranes, skin, and elsewhere, and there may be slight bloody effusions into the serous cavities. The spleen, liver, and kidneys are swollen and dark in colour. Rigor mortis in fatal cases is badly marked, and decomposition is very rapid.

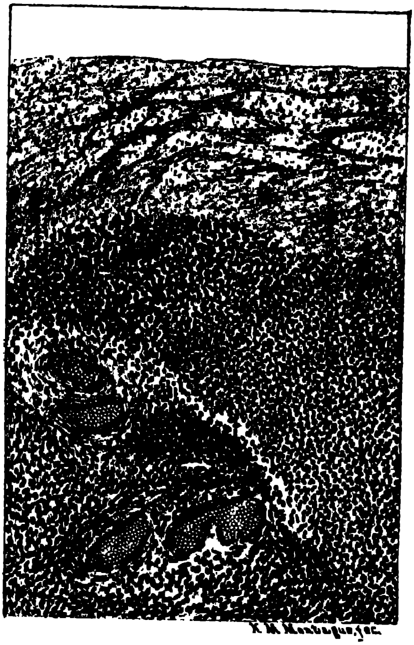

FIG. 378.—PUERPERAL ENDOMETRITIS DUE TO COLON INFECTION, SHOWING MARKED DEVELOPMENT OF LEUCOCYTIC WALL. (Williams.)

Symptoms.—The symptoms of sapræmia may be divided into two groups. In the first group are the local symptoms due to the presence of a centre of decomposition in the vagina or uterus, and in the second group the constitutional symptoms due to the absorption of ptomaines from this centre.

The first local symptom to appear is an alteration in the lochia, which, instead of being the sanguineous or sero-sanguineous discharge that occurs during a normal puerperium, become of a dirty brown colour, are increased in amount, and are extremely fœtid. They may also contain decomposing shreds of decidua and membranes. If the saprophytic infection has occurred during labour, these changes usually appear about the evening of the second or the third day, while, if the infection occurs during the puerperium, they appear correspondingly later. The diapers or cotton-wool pads, on which the putrid lochia are collected, often furnish very clear evidence of the presence of decomposition. The normal lochia stain the diaper as does blood, that is to say, they cause a stain which is red in the centre and which fades away gradually into a colourless margin, an appear-

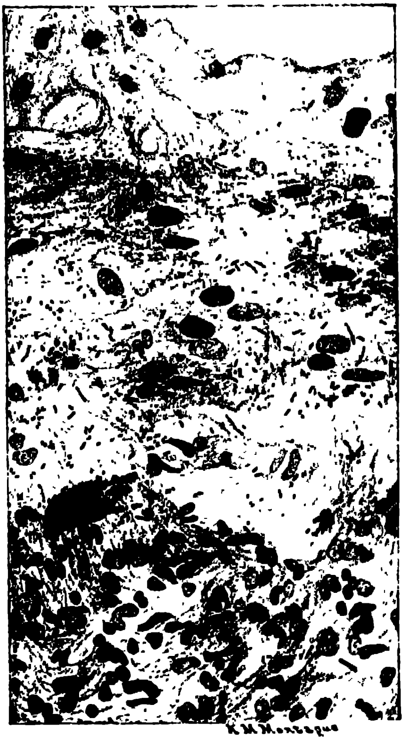

FIG. 379.—COLON BACILLUS ENDOMETRITIS; LEUCOCYTIC WALL NOT INVADED BY BACTERIA. × 800. (Williams.)

ance due to the collection of the fibrin and blood corpuscles in the centre of the stain, and the peripheral extension of the serum. The stain of decomposing lochia, on the other hand, is quite different. The centre is almost the palest part, and the edges are hard and deeply stained. This appearance, and the odour of decomposition that comes from the diaper, are quite characteristic. The next most important local symptom is the cessation of involution, a cessation which apparently is due to the effect of the absorbed toxins. The uterus remains for several days at almost the same size as it was on the first day after delivery, and often is extremely tender on pressure. In some cases, the enlarged fundus falls into a position of ante- or retro-flexion, and in consequence a small pool of decomposing lochia may collect in it, and, inasmuch as this means that the lochia are retained for an unduly long period in the uterus, the constitutional symptoms are usually aggravated. To this condition, the term *lochio-metra* is applied. If a putrid endometritis occurs, the foregoing symptoms are exaggerated.

The constitutional symptoms of sapræmia appear from the third to the fifth day, and usually commence gradually. The first symptoms are a slight elevation of the temperature to 101° or 102° F. and a corresponding increase in the rapidity of the pulse. The patient may also experience a slight chill or shivering fit, but this as a rule is insufficiently marked to be termed a rigor. If the uterus is washed out, and the source of the toxins removed, the symptoms usually disappear at once and completely. If, however, the patient remains untreated, the symptoms become more marked, and the temperature may rise a degree or so on the following evening, and the pulse-rate also increase. The patient, who up to this time has not complained of any ill effects, may now feel extremely ill. If the patient was still to remain untreated, these symptoms would become steadily worse, and her condition might become critical, particularly if septic organisms also had made their way into the uterus. In such cases, the symptoms become identical with those of local septic infection. As has been already pointed out, a purely saprophytic infection is of rare occurrence, and, if the symptoms become serious, it almost always shows that a mixed infection has occurred.

Diagnosis.—The diagnosis of sapræmic infection is usually an easy matter, as the changes in the character of the lochia are very evident. It is not, however, always easy to be sure that there is not a concomitant septic infection, unless a bacteriological examination is made. In cases of doubt, it is always well to make such an examination.

Treatment. — The principles of the treatment of sapræmia, shortly stated, are to remove, so far as possible, all saprophytic organisms and decomposing masses from the uterus and vagina, and to destroy, by means of antiseptics, those which cannot be removed. The removal of saprophytic organisms may be brought about by copious and repeated vaginal and uterine douches, and by promoting free drainage from the uterus. As soon as any symptoms of decomposition appear, the patient should be given a brisk purgative, as the straining which the latter causes helps to empty the uterus and vagina. If the third day is passed, the patient may be partially raised in bed by pillows, and also allowed to kneel in bed when passing water. If this treatment does not bring down the temperature within twelve or twenty-four hours, the vagina and uterus should be washed out with lysol or creolin solution, using a large Bozemann's catheter or glass nozzle. The douche should be given at a temperature of 98° to 100° F., and at least half a gallon of fluid should be passed into the uterus. This douche should be repeated night and morning until the lochia return to their normal condition.

If, in spite of douching, the lochia still remain foul, the uterus should be explored with the finger, to ascertain if any fragments of placenta or membranes have been left behind. If such fragments are found, they must be scraped away by the finger, or by means of a Rheinstädter's blunt curette. In using the latter, great care must be taken not to use too much force, as, in the softened condition of the uterine wall which often accompanies saprophytic infection, it requires but little force to pass the curette through the wall. If the uterine wall is rough and shaggy from portions of retained decidua, it may be lightly curetted all over, but in so doing one must remember that it is quite possible to remove pieces of softened uterine muscle, even with a blunt curette. We have seen quite large pieces of muscle removed in this way, under the idea that the curette was only removing retained placental fragments. If the lochia are retained in the uterus, it is well after douching to plug the cavity tightly with iodoform gauze, as this will promote drainage, and at the same time the iodoform will exert an antiseptic effect. A similar procedure may be adopted after curettage, in order to destroy those micro-organisms which have not been removed by the curette or by the douche. In such cases, the plug should be removed at the end of twelve hours, and, if necessary, a fresh one inserted. The prolonged action of iodoform has a powerful germicidal effect, and, when the drug is introduced into the uterus in small quantities, it is free from any unpleasant or dangerous consequence.

The only other germicides, from which we should be disposed to expect any good results, are formalin and peroxide of hydrogen. Of the powers of formalin there is little doubt, but it possesses the drawback that if allowed to act for too long on the tissues it sometimes gives rise to extremely severe pain. We have no personal experience of its use in puerperal cases, but, judging from its effect in subacute gonorrhœal infection of the uterus, we believe that it would prove of value in both putrid and septic endometritis. Formalin may be used at a strength of from ten to forty per cent., and should be injected directly into the uterine cavity, to prevent it from coming into contact with lacerations of the vagina or cervix, and then should be washed away as soon as it has acted for the required time. If it is used at a strength of forty per cent., it should not be allowed to act for more than thirty seconds, but, if used weaker, it may act for a proportionately longer time. If it causes pain, it must be washed away immediately, and so, when it is about to be injected, the operator must have a douche and Bozemann's catheter ready for immediate use. Peroxide of hydrogen may be used at a strength of from thirty to fifty per cent., and may be added to the douche, or directly injected into the uterus. On meeting with the decomposing lochia, oxygen is set free and free effervescence occurs. The peroxide should be slowly injected until effervescence ceases.

In all cases, the strength of the patient must be maintained by suitable food, and, if necessary, by the use of stimulants. If the patient is anæmic, iron may be given with advantage, provided that it does not interfere with her digestion. The administration of ergot is also advisable, as, by promoting uterine contraction, it hastens involution, and also lessens the absorption of toxins from the uterine cavity. A drachm of the liquid extract may be given, night and morning, for four or five days.

SEPTIC INFECTION

Any part of the genital tract may be the seat of septic infection, provided that a lesion of the mucous membrane has occurred. Unfortunately, such lesions invariably occur during delivery, and the more extensive the lesion the greater the opportunity for infection. It has already been mentioned, that primiparæ are more liable to puerperal sepsis than multiparæ, owing in part to the greater rigidity of their tissues, and the consequent greater frequency of lacerations. The interior of the uterus offers a favourable site for infection, as it presents, not only at the placental site, but where the decidua have come away, raw surfaces, through which bacterial invasion can occur.

The classification of puerperal septic conditions into *general* and *local* is for clinical purposes the most convenient. Pathologically, however, there is but little justification for it, as there is probably no such condition as a purely local sepsis. No matter how localised an infection may appear to be, it is accompanied in many cases by certain general results, as fever, headache, circulatory disturbances and leucocytosis, which are the manifestations of a general intoxication. In most cases, moreover, it is probable that a general infection or bacteriæmia occurs, since it is unlikely that an infection by streptococcus or the colon bacillus can be long continued without bacteria gaining access to the blood-stream.

In spite of this, for clinical purposes the conventional classification is convenient, and on that account we shall adopt it. Under the name of local infections, we shall describe those conditions in which the local changes are manifest, and the general changes have not demonstrated themselves by local lesions elsewhere, or by pronounced constitutional symptoms. As general infections, will be described those conditions in which the constitutional effects are so preponderant as to overshadow the lesions from which they take origin, and those in which secondary lesions occur at distal points.

LOCAL SEPTIC INFECTION.

Local infection of the genital tract is perhaps the most common form in which puerperal infection manifests itself. The extent of the infected area differs markedly in different cases, as the infection may be confined to a perinæal or labial laceration, may extend to the vagina and uterus, or may involve the entire genital apparatus and the pelvic cavity. We mention this lest the fact that we describe separately the effect of infection of the individual parts of the genital tract, might lead the student to think that in practice he will find infection strictly limited to such parts. Such a limitation may occur, but it is rare.

Lesions of the Vulva and Vagina.—Septic changes in the vulva and vagina show themselves in one of two forms, the ulcerative and the inflammatory. The ulcerative form manifests itself as the so-called *puerperal ulcer*, which forms on the site of lacerations or contusions the results of injury during delivery, especially when irritating discharges remain in contact with the part. It is most commonly found about the perinæum, the lower third of the vagina, and the labia. The ulcer may be bathed in a dirty and ill-smelling discharge or covered with a distinct diphtheritic membrane, consisting of necrosed tissue and coagulated discharges. The surrounding tissue shows the inflammatory changes which commonly take place around an ulcer. Bacteriological examination detects the presence of the *streptococcus pyogenes*, together with a host of putrefactive organisms. The term 'diphtheritic' applied to the membrane in these cases is of histological significance only, and does not suggest the presence of the diphtheria bacillus.

More common than ulceration is the occurrence of a diffuse inflammation situated usually at the posterior commissure of the vulva and in the posterior wall of the vagina. The inflammation is often located in small and scattered patches, which, as they extend tend to coalesce. These patches are covered by a white and firm membrane, composed almost entirely of fibrinous exudate and extravasated leucocytes, with a few epithelial cells. In other cases, there is a general catarrh of the vagina; in the earlier stages this is associated with a swollen and red condition of the mucous membrane, and later with a purulent discharge. In the most severe forms, a diphtheritic slough forms over a large extent of mucous surface.

Superficial lymphangitis may occur in connection with vulvar infections, with consequent implication of the inguinal glands.

Quite distinct from these streptococcal infections is the rarer condition of true diphtheria of the vulva and vagina. When this occurs in these regions during the puerperium, it does not, however, present any special features distinct from those presented at other times or in other situations. It is accompanied by the usual general symptoms of diphtheria.

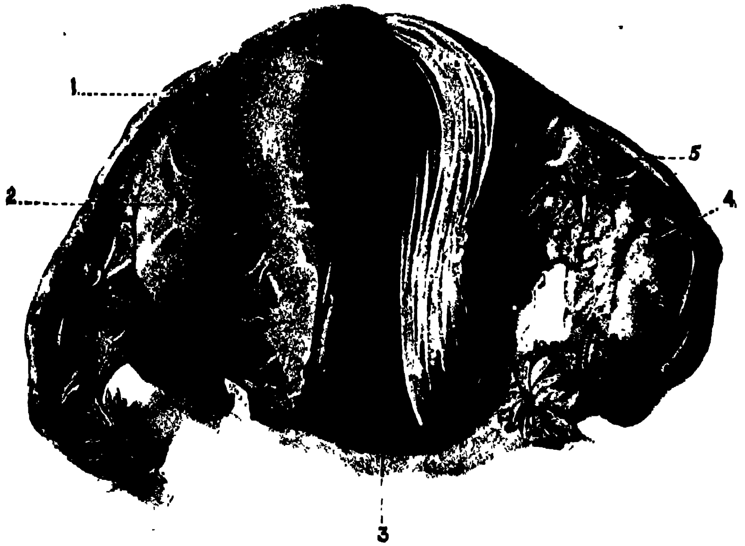

FIG. 380.—UTERUS REMOVED FROM A PATIENT WHO DIED OF ACUTE SEPSIS. Note the abnormally smooth condition of the endometrium.

1, Left Fallopian tube; 2, left ovary; 3, os externum; 4, right ovary; 5, right Fallopian tube. (From a specimen in the Museum of the Rotunda Hospital.)

Lesions of the Uterus.—Although inflammations of the uterus are not only the most common, but by far the most serious of the lesions due to puerperal infection, it is rarely that they can be correctly termed 'local sepsis,' as they are usually associated with a pronounced sapræmia or with a general infection. There are two main types of puerperal endometritis—putrid endometritis and septic endometritis. The former has been already described, while the latter, though more commonly associated with general sepsis than with a purely local condition, may conveniently be described here.

The septic type of endometritis in its acutest form is due to invasion of the tissues by a virulent streptococcal or staphylococcal infection. It may attack any part of the inside of the uterus, and usually remains localised to the area first infected. The lochia may be increased in quantity, but in the more acute cases are usually diminished or even absent. They may become purulent in character, but are not fœtid. The infection quickly spreads to the deeper layers of the uterine wall, and obtaining access to the lymph or blood stream, causes general and often fatal septicæmia. The seriousness of the condition is due to the danger of such extension, as the local changes, even in fatal cases, are remarkably slight. The interior of the uterus will be found to be quite smooth, the wall as a whole is firm, and it is evident that there has been no destruction of tissue in mass (*v.* Fig. 380). There is consequently no tissue which could be removed by the curette.

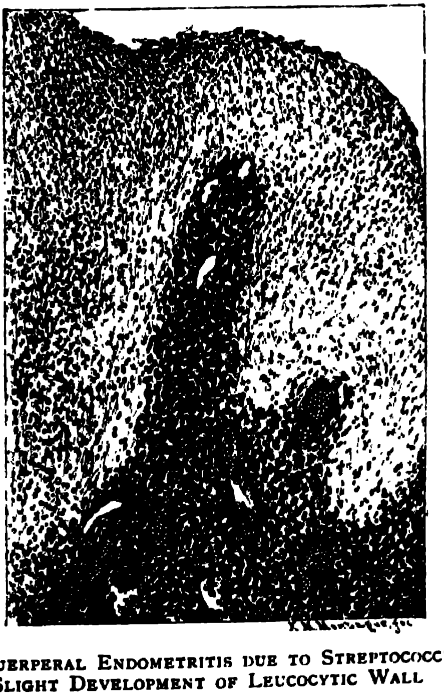

FIG. 381.—PUERPERAL ENDOMETRITIS DUE TO STREPTOCOCCUS INFECTION, SHOWING SLIGHT DEVELOPMENT OF LEUCOCYTIC WALL (Williams.)

Microscopic examination of the endometrium in these cases shows the nature of the changes which are present. There is superficially a thin layer of necrosed cells blended with fibrinous exudate, to which the unnatural smoothness is due. Immediately below this, in the deeper layers of the endometrium, there is a slight degree of leucocytic infiltration (*v.* Fig. 381), which, in amount, is in marked contrast to what we have seen in putrid endometritis. Both toward the surface and in the leucocytic zone, streptococci are present in large numbers (*v.* Fig. 382), and they can be also found in the lymph channels which pass through the muscular walls towards the peritoneal surface. The entire appearance points to an attack so rapid that the usual tissue resistance to bacterial invasion has not had time to occur.

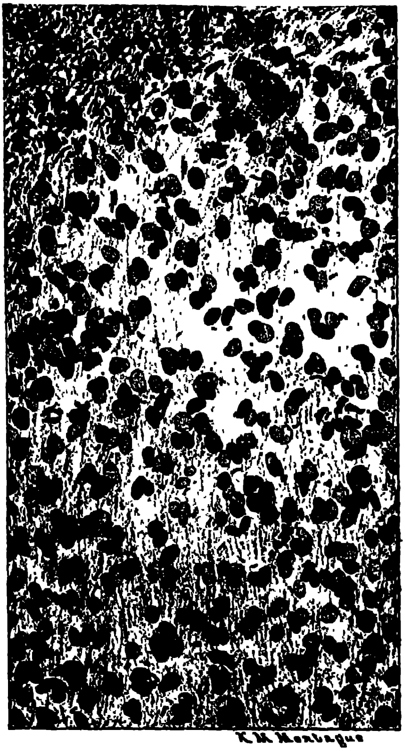

FIG. 382.—STREPTOCOCCIC ENDOMETRITIS, SHOWING INVASION OF LEUCOCYTIC WALL. × 800. (Williams.)

The foregoing description applies rather to the condition of the uterus in a typical case of acute general sepsis than to the actual condition most commonly met with. In the ordinary cases of less virulent infection, the uterus presents changes which are intermediate between those just described and those present in putrid endometritis. The organ is large, its wall thickened, and its tissue friable. The surface shows much more marked changes than in the acute septic variety, but there is not as much destruction of tissue as in putrid endometritis. The exudate is purulent and often bloody, and consequently the lochia are increased in quantity. There are, in fact, the usual results of a severe catarrh with a purulent exudate. In some cases, the exudate contains a larger number of cells than does ordinary pus, and a distinct false membrane lining some portion of the interior of the uterus appears. To this condition the term 'diphtheritic endometritis' was formerly applied, and it was described as a distinct variety.* There is, however, no ground for such a distinction, as no line can be drawn between it and the other conditions we have described.

In many of the cases of this intermediate class, particularly those most closely approaching putrid endometritis, the colon bacillus is present, either alone, or more commonly as one element of a mixed infection. When it is present, as has been already mentioned, the lochia are foul smelling, and often frothy owing to the production of gas (*v.* Fig. 383).

In many of these cases, putrefactive organisms are also present in the uterus. The toxins produced by them facilitate the advance of the parasitic organisms into the uterine walls, or, in other words, the presence of a decomposing fluid adds virulence to comparatively inactive pyogenic germs.†

Occasionally, a very mild form of septic infection occurs without general symptoms of importance following. In such cases, the inflammation is in the form of a slight catarrh, and the lochia are at first diminished, but afterwards increased. This form may result from direct extension of a catarrh of the vagina, and is due to the presence of the *staphylococcus aureus.* Some of these cases present a close resemblance to the diphtheritic form just mentioned.

Where endometritis results from gonococcal infection it is usually mild in character, and is often unaccompanied by general symptoms.‡

In most cases of endometritis of septic origin, an extension of the infection into the muscular coat of the uterus occurs. Such a metritis is not a separate condition, but is merely an extension of the infective process already described. In some cases, however, a metritis of a different kind occurs. During their passage through the lymphatics of the uterine wall, bacteria may become lodged at any point, and there give rise to segregated foci of inflammation, possibly resulting in abscess formation, either in the muscle, or, more frequently, between the muscle and the peritoneal covering.

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* Hervieux, 'Traité des Maladies Puerpérales,' p 240; 'American Textbook of Obstetrics,' vol. ii., p. 694.

† Edgar, 'Practice of Obstetrics,' p. 464.

‡ *Ibid.*, p. 777; Varnier, 'Obstétrique Journalière,' p 413 *et seq.*

When thrombi form in the uterine veins at the placental site, as sometimes happens, they are very liable to become infected, and give rise to a condition of phlebitis (*v.* Fig. 384). This is most likely to occur when such procedures as the manual detachment of the placenta have been performed. Phlebitis may also

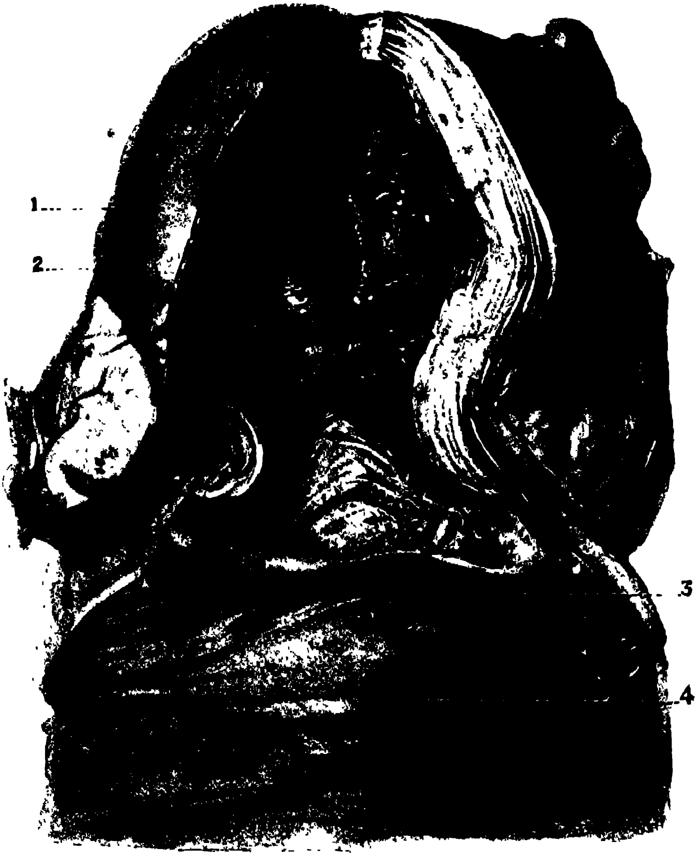

FIG. 383.—UTERUS REMOVED FROM A PATIENT WHO DIED OF MIXED SEPTIC AND SAPROPHYTIC INFECTION.

Note the rough and necrotic lining of the cavity.

1, Fallopian tube; 2, ovary; 3, os externum; 4, vagina. (From a specimen in the Museum of the Rotunda Hospital.)

arise apart from the occurrence of thrombosis, by the spreading of inflammation to the walls of the veins from the tissues surrounding them. If the organisms are virulent, abscesses may occur along the veins, and so a condition arise very similar to the suppurative metritis already described as resulting from lymphatic infection. More important results, however, are spreading phlebitis, pelvic cellulitis and general pyæmia, of which mention will presently be made.

Extra-uterine Pelvic Lesions.—When bacteria have infected the uterus they may pass to the parts surrounding it by one of several paths. They may travel directly along the Fallopian tubes, causing inflammation as they go. They may pass by means of the veins, either by an extending phlebitis, or by the breaking off from a thrombus of infective emboli. Finally, they may be carried directly through the uterine walls in the lymph spaces and lymphatic vessels. We shall see that infection by each of these paths actually occurs, the resulting lesions differing in each case.

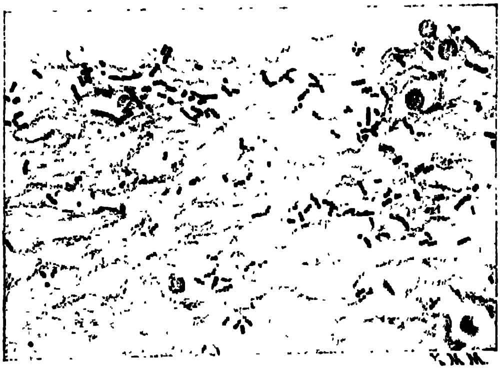

FIG. 384.—SECTION THROUGH A THROMBOSED PELVIC VEIN, SHOWING STREPTOCOCCI × 800. (Williams)

Salpingitis and Oöphoritis.—Salpingitis occurs when the infection travels directly from the uterine cavity to the tubes. It is catarrhal in nature, with, in severe cases, a purulent exudate. When it is the result of a gonococcal infection, it occurs late in the puerperium.

Oöphoritis is not common, but the infection may be carried to the ovary either by lymphatic channels from the uterus, or by direct extension from an infected Fallopian tube. The ovary becomes enlarged and œdematous, and may be the seat of numerous small abscesses, or its parenchyma may be destroyed and a single abscess cavity result.

Pelvic Cellulitis.—One of the commonest results of inflammation of the uterus is involvement of the peri-uterine connective tissue, or parametritis.* The micro-organisms reach the part through the lymphatics coming from an area of infection in the uterus or cervix. In some instances, the condition springs from phlebitis which has spread to the pelvic veins. The resulting inflammation shows itself by œdema and possibly by thrombosis, often followed by suppuration. The lymphatic glands of the sacral and internal iliac groups are always affected, and suppuration may begin in them; not infrequently the lumbar chain of glands is also affected. The suppuration, whether originating in the glands or in the cellular tissue, is often considerable in extent, and a large burrowing abscess may form. If unopened this may burst into the peritoneum, or into one of the hollow viscera in the neighbourhood; or, more commonly, remaining in the connective tissue, it may make its way to the surface, and point in the groin, the iliac region, or above the pubis. Cases have been recorded where a burrowing abscess has ascended behind the peritoneum until it penetrated the diaphragm and reached the thorax.

Pelvic Peritonitis.—This condition may arise in various ways. The most common is by the direct passage of bacteria through the lymphatics of the uterus, and inflammation originating in this way is a very frequent result of septic endometritis. A similar condition may follow infection of the vagina or cervix. On the other hand, local peritonitis may be secondary to cellulitis, and may occur either by direct extension of the infective process, or as a result of the rupture of a pelvic abscess. In rarer instances, infection reaches the peritoneal surface along the course of the Fallopian tubes.

Pelvic peritonitis, or, as it is sometimes called, perimetritis, never occurs without some degree of associated cellulitis, so that one meets together the changes due to inflammation of serous membrane, and of subserous tissue. Its most common seat is the pouch of Douglas and the posterior uterine wall. The changes undergone by the serous membrane vary greatly in degree. In the milder cases, the peritoneum and underlying tissues become sodden and œdematous, and a fibrinous exudate appears on the surface. Adhesions rapidly form between the peritoneal surfaces of the uterus, rectum, and small intestine. The last-named becomes glued to the pelvic viscera, and the parts are densely matted together.

In severer cases, the exudate is of a more cellular character, and forms a membrane over the affected surfaces. If the process continues, these surfaces are finally bathed in pus, which tends to collect in the pouch of Douglas, or, in some cases, in the utero-vesical fossa. If the infection is to remain local, the pus must become encysted, and this end is aided by the adhesions which have already formed. Even after a collection of pus becomes circumscribed, a sudden exertion or other cause may break down the adhesions, and general peritoneal infection follow.

Cystitis.—Among the local manifestations of puerperal sepsis it is necessary to mention one other pelvic infection not uncommon in the puerperal state, namely, inflammation of the bladder. In some cases infection of the bladder is secondary to that of the vulva, from which it either travels by direct extension through the urethra, or is carried to the bladder on a catheter. If the infection spread by the urethra, catarrh of that duct is also present. Cystitis may, however, occur without any obvious vulvar infection, the bacteria being carried to the bladder on a dirty catheter. The active organism is most commonly the colon bacillus. Having reached the bladder, the infection may extend to the ureters and pelvis of the kidney. In rare cases, infection passes to the bladder from an antecedent pelvic cellulitis or peritoneal infection.

General Peritonitis.—The classification of general peritonitis presents some difficulty, as it is doubtful whether it should be treated as a local lesion spreading from the pelvis, or as a manifestation of a general condition. It occurs in both of these relations, but at present we are alone concerned with the former.

General peritonitis, as an inflammation of local origin, may rise by the extension of an infection occurring in any of the pelvic sites enumerated. Most commonly, it is either an extension through the lymphatics of an acute septic endometritis, or else a direct extension of a pelvic peritonitis. In the latter case, it may be due to the sudden breaking of the adhesions circumscribing a suppurating focus. The rupture of a cellular, tubal, or other abscess into the peritoneum, brings about a similar result.

In the most acute cases of peritonitis, death may result before there is time for any noticeable anatomical change to take place. The peritoneum will be found, however, to contain a thin, blood-stained serum, which swarms with bacteria. More often a distinct inflammatory reaction will have taken place. The entire peritoneal surface will be covered with a purulent and milk-like exudate, in which the intestines are bathed. If the exudate is more fibrinous, it will appear as a false membrane, and adhesions will be present. When a fluid exudate is in process of absorption, curd-like flakes are found lying between the viscera. In case the inflammation has spread from a pelvic focus and is not due to rapid lymphatic infection, these changes are always well marked. General peritonitis, by extension through the diaphragm, occasionally gives rise to pleuritis or pericarditis.

Symptoms.—The symptoms of local septic infection are, according to the nature of the particular case, those of acute septic vaginitis, endometritis, salpingitis, or pelvic peritonitis or cellulitis as the case may be.

In septic vaginitis and vulvitis, the vulva and vagina are swollen, inflamed, œdematous, and exceedingly tender. Usually, on examination, one or more puerperal ulcers will be found, corresponding to lacerations of the mucous membrane. In a very acute case, the patient may be unable to endure the introduction of even one finger or of the nozzle of the douche into the vagina.

The local symptoms of acute septic endometritis are not very clearly distinguishable from those of putrid endometritis, and the distinction is the more difficult to make in that, in the majority of cases, the infection is 'mixed' saprophytic and septic. In a purely septic infection, the lochial discharge lacks the offensive odour which is characteristic of decomposition, and consists in great part of pus, with which a varying quantity of blood is mixed. Uterine involution ceases, and the uterus is perhaps more tender than in the case of saprophytic infection. If the discharge is examined bacteriologically, colonies of the invading bacterium will be found. In a mixed infection, the discharge is similar to that which is present in putrid endometritis. The constitutional symptoms are also very similar to those of the latter condition, save that, as a rule, the temperature is higher and the pulse-rate is more rapid in proportion to the temperature. Both of these differences, however, largely depend upon the nature of the invading organism. In septic endometritis, rigors may occur, but as a rule these are the result of the extension of the infection to hitherto exempted tissues, and not of the endometritis.

The extension of infection beyond the uterus into the tubes, the parametrium, and the peritoneal cavity is shown by an increase in the severity of the symptoms, the occurrence of rigors, and of a varying degree of pain. If the infection remains localised to the pelvic cavity, the pain is more marked, and is usually due to the formation of limiting adhesions between the intestines and the pelvic peritoneum. In such cases, the lower part of the abdomen is extremely tender, and, even from the first, a sense of increased resistance can be felt over the infected area. As the results of the extension of the infection become more marked, this resistance hardens into a definite swelling, which can be felt either by placing the hand on the lower part of the abdomen or by making a vaginal examination. The situation of this swelling depends upon the course the infection has taken, and has been already described. If the infection extends into the general peritoneal cavity, the abdomen becomes distended and tympanitic, owing to paralysis of the intestines, and for the same reason there is usually complete constipation. In these cases, pain is as a rule absent. The constitutional symptoms are very similar to those of acute lymphatic sepsis.

Diagnosis.—Accurate diagnosis of the nature and the extent of local septic infection is of the most far-reaching importance. In order to effect it, three facts must be ascertained. The first of these is the nature of the invading organism, and, to ascertain this, in all cases of infection a portion of the discharge should be collected, with due precautions from the interior of the uterus, and examined bacteriologically. The chief object of the bacteriological examination is to ascertain the presence or absence of staphylococci and streptococci, as the presence of saprophytic organisms in any numbers can be determined from the odour and appearance of the lochia. We thus ascertain whether the infection is purely saprophytic, 'mixed,' or septic. The second fact is the condition of the interior of the uterus. To ascertain this, the finger should be introduced and the condition of the endometrium carefully examined with a view to determining whether portions of placenta or membranes have been left behind, and whether the endometrium is smooth or rough and shaggy. The third fact is the extent to which the infection has extended, beyond the uterus. The diagnosis of the extension of septic infection beyond the uterus can be made from the increased severity of the symptoms, the increased pain, the presence of rigidity and increased tenderness to one or other side of the uterus, and, later, the presence of a definite swelling. The existence of general peritoneal infection is shown by a still more marked increase in the severity of the symptoms, the distended condition of the abdomen, intestinal paralysis, the characteristic appearance of the tongue, and the general aspect of the patient.

Treatment.—The correct treatment of local septic infection of the genital tract after delivery is still the subject of discussion. Many writers, and notably Pryor of New York,* advocate the adoption of heroic measures, to which we shall presently refer. Others advise the adoption of less heroic measures, the chief of which are repeated douching, and curetting of the infected uterus. In this class are found the majority of British obstetricians. Still others, and notably Bumm and Whitridge Williams,† consider that curetting as a routine measure is by no means to be recommended, and that repeated intra-uterine douching, especially in streptococcal infection, is not only useless but perhaps harmful. In the face of these diverse opinions, for all of which those who hold them can produce supporting statistics, it is unwise to attempt to dogmatise, and we shall content ourselves with describing the treatment we consider to be most suitable.

The treatment of purely saprophytic infection has been already described, and, in our opinion, the local treatment of a 'mixed' infection should be very similar. The treatment of a purely septic infection is, however, another matter, and, in deciding upon the course to adopt, we should be guided by the condition of the interior of the uterus. If the endometrium is shaggy, and small portions of retained placenta, membranes, and decidua are adherent to it, they should be gently removed with the finger or with a blunt curette, and the uterus then plugged with iodoform gauze. This plug must be removed at the end of twelve hours, and, if necessary, a fresh one inserted after first douching out the cavity. If, on the other hand, the inside of the uterus is quite smooth, a condition that is found in the most acute forms of streptococcal infection, curetting is contra-indicated, and the douche and the plug are probably useless. In these, and indeed in all forms of local septic infection of the uterus, we should be inclined to practise the injection of a strong solution of formalin (from twenty to forty per cent.) into the uterine cavity. The formalin should be quickly injected in sufficient quantity to ensure its reaching the entire surface of the endometrium, *i.e.*, from two to four drachms, and washed out after fifteen to thirty seconds have elapsed. The penetrating power of formalin is considerable, and our experience of its use in non-puerperal cases leads us to believe that injected in the manner we have described it would not produce any harmful effect upon the patient, and would exert a deterrent effect on the development of the invading micro-organism.

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* 'The Treatment of Pelvic Inflammation,' p. 34. Philadelphia, 1899.

† 'Obstetrics,' p. 786. New York, Appleton and Co., 1903

In cases in which infection has extended beyond the uterus into the parametrium, the tubes, or the pelvic cavity, our treatment, at first at all events, must be palliative, and constitutional. Hot fomentations over the lower part of the abdomen, and hot vaginal douches given at a low pressure, will help to relieve pain. Hypodermic injections of morphia may be also necessary with the same object. Later, if pus forms, it must be evacuated. When it forms in Douglas' pouch, or the parametrium, or in tubes which have prolapsed into Douglas' pouch, this can be done best through the posterior vaginal fornix. Occasionally, the abscess cannot be reached from below, and may extend upwards until it comes to point on the abdominal wall, usually a short way above Poupart's ligament. In such cases, it must be opened where it points.

If general septic peritonitis occurs, surgical intervention, at the earliest moment, affords the only hope of relief. In such cases, the abdomen must be opened, thoroughly washed out with saline solution, and drained both through the floor of Douglas' pouch into the vagina, and through the abdominal wound.

As we have mentioned, much more radical measures, than those we have described, are recommended by various writers. Of these measures, the two most important are the opening of the posterior fornix of the vagina and the drainage of Douglas' pouch, and hysterectomy. Pryor, so far as we know, is responsible for the introduction of the former of these procedures. His practice consists in curetting the uterus in all cases in which he considers that septic organisms have passed deeply into the uterine tissues, and in opening into Douglas' pouch whenever he curettes the uterus. He then breaks down any adhesions that may have formed and plugs Douglas' pouch with iodoform gauze. We consider that such a procedure is rational and suitable, when we know that infection has extended into Douglas' pouch, and when such infection has been shut off by adhesions from the general peritoneal cavity. On the other hand, we cannot regard it as either scientific or wise in cases in which there is no reason to believe that Douglas' pouch is infected, or in which it establishes an opening into the general peritoneal cavity. The performance of hysterectomy in cases of acute puerperal infection of the uterus does not appear to us to be an operation with any future before it, although it has been recommended and successfully practised by several distinguished operators. It is conceivable that occasionally a life, which would have been otherwise lost, might be saved by such a procedure, but the difficulty of determining the type of case, in which such a result might be obtained, is to our mind insuperable, and in many cases instead of improving it must prejudice the prospect of recovery. If the operation is to offer a fair prospect of success, it must be undertaken before the infection has spread beyond the uterus, but to perform it in all cases of uterine infection would mean the mutilation and even the death of many patients who might have recovered if simpler measures had been adopted.

The constitutional treatment of local septic infection consists in the maintenance of the patient's strength in every way possible. The free administration of stimulants, and of such drugs as iron, strychnine, and digitalis when the condition of the heart necessitates their use. The administration of ergot is also indicated, with the object of promoting uterine contraction, and so lessening the absorption of toxins from the uterus. The bowels must be made to act regularly. If the temperature attains a very high range, it should be brought down by cold sponging or the cold pack. If the infection is streptococcal, the use of anti-streptococcic serum and the subcutaneous injection of saline solution may be advisable. These measures will be discussed when we are considering lymphatic sepsis.

GENERAL SEPTIC INFECTION.

The systemic septic infections of the puerperium spread by one of two channels—the lymphatic vessels, or the veins.

SEPTICÆMIA OR LYMPHATIC SEPSIS.—In lymphatic sepsis, the micro-organisms have made their way from the endometrium, or from some other focus of infection, into the lymph-spaces. If possessed of sufficient resistance to overcome the bacteriolytic powers of the lymph, they are rapidly carried upward through the main lymph channels and discharged into the blood-stream. By this means, they are carried into all parts of the body, and, if the case is severe, they can be separated from the circulating blood or body fluids. In the most extreme cases, such as those due to virulent streptococcal infections, anatomical changes are almost entirely absent, as the patient succumbs rapidly to the toxins produced. In cases of less virulence, the microscopic conditions already described as typical of acute septic endometritis are noticeable locally, and sero-sanguineous effusions into the peritoneal, pleural, and pericardial cavities are frequently observed, the effused fluid swarming with bacteria, while the serous membranes may present punctate hæmorrhages. The latter appearance is also common in the pia mater, and may be found both in the large and small intestine. The spleen, liver, and lungs are large and soft, being congested and œdematous. The muscles are probably of darker colour than normal. The blood shows marked leucocytosis, it does not coagulate easily, and it is of a tar-like consistency.

An occasional manifestation of lymphatic sepsis, and one which is of importance from a diagnostic point of view, is a general erythema closely resembling the rash of scarlatina.

It cannot be too strongly impressed on the mind that the danger in lymphatic sepsis lies in the intoxication produced by bacterial products, and not in the anatomical injuries due to the direct attack of the bacteria. The anatomical changes are only of importance as marking how widely the infection has been distributed. It is obvious that, the greater the number of bacteria present, assuming equality of virulence, the greater the amount of toxins produced, and therefore the more serious the condition of the patient.

It is impossible to speak with certainty of the mode of action by which the toxins are able to destroy life, since their chemical relations are by no means clear. It is usual to class them with the albumins under the name of 'toxalbumins,' but it is questionable whether they can be all thus grouped. Each race of pathogenic organisms seemingly produces a specific toxin, whose effect is part of the effect produced by inoculation with the organism itself.

Symptoms.—The symptoms of lymphatic sepsis commence on the second or third day after inoculation, and, as a rule, are well marked. They are usually ushered in by a severe rigor, after which the temperature may rise to between 103° F. and 105° F., and the pulse-rate increase to between 120 and 140. The patient may at first sweat profusely, but subsequently, as the toxæmic condition becomes more marked, the skin becomes dry. Rigors may recur at intervals, and after each the temperature rises to a higher level. The lochia and milk may never appear, or, if they have appeared, may cease. The aspect of the patient is characteristic. She looks extremely ill, her face pinched and slightly jaundiced, her eyes sunk into their sockets, and the angles of the mouth and nose drawn down. A common symptom is extreme depression, and, in cases of comparatively mild infection, this may be the first symptom to appear. In very virulent infection, on the other hand, the patient may say that she feels well, and be cheerful, and even express a wish to be allowed out of bed. This condition is known as *euphoria*, and is due to the dulling of the higher centres by the bacterial toxins that are circulating in the system. In some cases, an acute general peritonitis may occur concurrently with the general systemic infection. The temperature tends to maintain a steady upward range, until it finally reaches a height of 106° F. or 107° F., and the pulse to become more and more rapid and weaker. Finally, the patient sinks into a state of unconsciousness, and death soon occurs. The duration of the disease in fatal cases is rarely more than four or five days, but it may last a week.

Diagnosis.—The diagnosis of lymphatic sepsis can be made from the high range of the pulse and temperature, the absence of evidence of local septic or saprophytic infection, and the general appearance of the patient. If the lochial discharge is examined bacteriologically, it will usually be possible to find streptococci, and, occasionally, they may be found also in the blood.

An appliance devised by Döderlein will be found very convenient for obtaining lochia from within the uterus. It consists of a piece of slightly bent glass tubing, eight inches in length, of the calibre of an ordinary lead-pencil, and with open ends. It is placed inside a larger glass tube, and both are sterilised. When required for use it is removed from the larger tube, and, with the aid of a speculum and volsellum, the bent end is passed through the cervix, which has been first carefully wiped with sterile wool. The other end of the tube is now connected with a syringe by means of a rubber tube, and suction applied. Some of the contents of the uterus enter the tube, which is then removed, and both ends having been at once closed with sealing-wax, it is despatched to a laboratory for investigation.

Treatment.—The treatment of acute lymphatic sepsis is, so far, most unsatisfactory. For a time, it was hoped that the introduction of Marmorek's serum would prove of value, but experience has not supported this belief. A committee appointed by the American Gynæcological Society* inquired exhaustively into the results obtained by the use of this serum, and reported that they could find nothing in clinical or experimental literature, or in their own experience, to indicate that the employment of the serum will materially improve the general results in the treatment of streptococcal puerperal infection. Local measures, as douching and curetting, have been found to be valueless, as is only to be expected when the extent of the infection is taken into account.

Our treatment must be, in the main, symptomatic, and be especially directed to maintaining the strength of the patient. With this object, alcohol should be given in the largest doses possible up to even sixteen or twenty ounces in the twenty-four hours. Strychnine and digitalis may also be given either hypodermically or by the mouth, with the object of strengthening and maintaining the action of the heart. If the temperature rises above 105° F., it should be reduced, if possible, by sponging with cold water, or by a cold pack. The administration of quinine and suchlike antipyretics is of little or no value. Subcutaneous or intravenous injections of saline solution, on the other hand, have sometimes proved of use. From one to three pints should be injected at the time, and repeated every twelve hours, or even more frequently if they appear to produce a good effect. If it is decided to give anti-streptococcic serum a trial, a first injection of 20 c.cs., is administered, and then 10 c.cs. every twelve hours, until a considerable improvement is manifested. As soon as this occurs, the amount and the frequency of the injections may be diminished. When using the serum, strict precautions must be taken to ensure the asepsis of the syringe with which it is injected, and of the skin through which the puncture is made.

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* *Trans. of the American Gynæcological Society*, 1899, vol. xxiv., p. 80.

Of late years, the value of a 'polyvalent' serum, that is a serum prepared from a horse which has been inoculated from several different strains of streptococcus, has been the subject of enquiry. Van de Velde and Peham* have prepared polyvalent serums from strains of streptococcus obtained from different varieties of streptococcal infection such as erysipelas, general sepsis, peritonitis, etc., and have obtained good results. Foulerton † and Bonney, on the other hand, have prepared a serum from strains obtained from different cases of 'puerperal fever,' and in two cases of very acute streptococcal infection, the use of their serum, prepared from five different strains, was followed by good results. The manner in which antistreptococcic serum produces its effect is not clear, as is shown by the fact that while Peham considers that it acts as a bactericide and checks the growth of the bacteria, but does not exert any actual antitoxic action, Foulerton regards its action as purely antitoxic. The latter writer lays particular stress on the dosage, and considers that the initial dose must be large, and that injections must be subsequently repeated until the symptoms of infection cease. He advises to commence with an initial injection of at least twenty cubic centimetres, and to repeat it, if necessary, at least once in every twenty-four hours.

The value of a polyvalent serum has still to be ascertained, but, at least, it may be said that, as it is impossible to ascertain the nature of the infecting strain of streptococcus in an individual case, or, even if it could be ascertained, to prepare a corresponding serum, the polyvalent serum increases the chance of successfully combating the infection. To be of value, however, the serum must be freshly prepared, and a sufficiently large dose must be administered.

Various toxic symptoms not infrequently follow the use of antistreptococcic serum, such as cutaneous eruptions and joint pains. These symptoms are probably mainly due to the introduction into the system of horse serum. They are transient, and, in comparison with the condition for which the serum is used, are of no importance.

Other remedial measures that have been recommended are unguentum Credé and a substance known as nuclein. Unguentum

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* *Archiv f. Gynäk.*, 1904, vol. xxiii., Heft 1.

† *Lancet*, 1904, vol. ii., p. 1828.

Credé, as its name implies, was introduced by Credé, and contains fifteen per cent. of a silver salt called collargolum. Cases in which apparent benefit have followed its use have been recorded, and, as it is a simply adopted remedy, it may be tried without prejudicing the effect of other treatment. From fifteen to forty-five grains should be rubbed once or twice daily into the skin on the inner aspect of the thigh, the duration of the inunction being from fifteen to twenty minutes. The site of inunction should be then covered with rubber tissue. Another method of introducing the silver into the system consists in the injection of soluble collargolum, dissolved in distilled water, under the skin or into a vein. A half, or a one per cent. solution is used, and, as a rule, from two and a half to five drachms of the former, or from a drachm and a quarter to two drachms and a half of the latter are injected. Nuclein is a substance obtained from yeast, and, when introduced into the system, is said to cause an artificial leucocytosis, and thus to increase the natural resistance to bacterial invasion. It can be given hypodermically or by the mouth.* In the former case, the initial dose is ten minims twice a day, and this amount is increased by five minims daily. In the latter case, from half a drachm to a drachm is given twice daily. Like antistreptococcic serum, nuclein sometimes causes severe pains in the bones, especially in the tibia, but these as a rule disappear within a week.

PYÆMIA.—The condition that results, when the infection is carried by the veins, presents many of the features of lymphatic sepsis, and also presents others that are distinctive. 'Pyæmia may be defined as septicæmia *plus* thrombotic and embolic accidents which lead to distribution of infectious material to all parts of the body.' †

Pyæmia is due to the breaking-off and distribution by the blood-stream of fragments of infective thrombi. It may occur whenever the veins of the uterus or pelvis have been infected, whether the infection was due to primary thrombosis at the placental site, or to a phlebitis spreading to the veins from the uterine wall or cellular tissue. The fragments of clot travel in the blood-stream, and, wherever they lodge, new foci of infection originate, resulting in a large number of small abscesses. The commonest site of these secondary abscesses is the lungs, but they frequently are eventually found in the kidneys, spleen, and liver, and may occur anywhere in the body.

Septic endocarditis is a common occurrence in pyæmia. The left side of the heart, particularly the mitral valve, is the part usually affected, though right endocarditis may result from the lodgment of an infective embolus carried direct from the pelvis. A copious exudate is formed, which, being swept away, leaves a deep ulcerating surface, on which an exudate again forms. As the vegetations thus formed are swept away in the blood, they may be carried to the brain, cerebral membranes, or retina, causing various lesions in those sites. A purulent synovitis of one or more of the large joints is not uncommon as one of the metastatic infections of pyæmia.

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* Hof bauer, *Centralb. f. Gynäk.*, 1896, vol. xx., No. 17, p. 441.

† Roswell Park, 'Treatise on Surgery,' p. 104.

In addition to the disseminated lesions just described, a case of pyæmia presents many of the general changes, such as effusions and extravasations, as well as changes in the blood, described as occurring in septicæmia. In pyæmia, however, the toxæmia is, as a rule, less in degree, and the tissues attacked are consequently able to make a better resistance. We have, therefore, in this case a disseminated, and in septicæmia a diffuse, infection.

Symptoms.—The symptoms of pyæmia differ from those of lymphatic sepsis, in that they appear at a later date, and that they are essentially of a remittent type instead of being continuous and progressive. The actual symptoms of the pyæmic infection, as a rule, do not occur until after the eighth day, but, in many cases, they are preceded by the symptoms of a local septic infection. The first symptom is usually a rigor, followed by a sudden rise in the temperature and the pulse-rate, the former reaching from 104° F. to 106° F., and the latter from 110 to 130. In a few hours, the temperature falls to normal, and the patient may appear to be as well as she was prior to the attack. Another rigor, however, usually follows, with a more marked rise of temperature, and this is succeeded by others according as additional infected emboli break away from the uterine circulation, and are carried to previously healthy tissues. The remaining symptoms of pyæmia are due to the local metastatic infection that occurs in the tissues to which the infected emboli have been carried. It has often been noticed that these emboli tend to follow one or other of two courses, and either tend to pass into, and infect, the deeper tissues and organs of the body, or to lodge more superficially in the skin and joints. In the former class of case, abscesses may form in the lungs, liver, brain, etc., or a septic pneumonia may result. In the latter class, abscesses may form in the subcutaneous tissues or in the joints. The gravity and persistence of the symptoms is in proportion to the virulence of the infecting organism. In severe cases, the periods of intermission of pyrexia become shorter, and, finally, the pyrexia becomes persistent. The patient then passes into a condition resembling that met with in lymphatic sepsis, and soon succumbs.

Diagnosis.—If rigors and rise of temperature occur in a patient in whom the genital tract is known to be infected by pyogenic organisms, the diagnosis of pyæmia may be almost definitely made. If, however, the lochia have not been examined, it may not be possible to make a certain diagnosis until the appearance of metastatic infections.

Treatment.—The treatment of pyæmia must be turned in three directions:—The strength of the patient must be maintained; the centre, from which the septic emboli are coming, must, if possible, be rendered aseptic; and the areas of metastatic infection must be treated. With the object of maintaining the strength of the patient, she must be given as much fluid and solid nourishment as she can digest. If iron can be administered without interfering with the digestion of the patient, its use is as a rule indicated, either alone or in combination with strychnine. The administration of alcohol is also usually necessary, and in acute cases must be pushed as far as the patient will allow, as in the case of lymphatic infection. The centre from which the infected emboli are coming is, as a rule, the uterus, and the treatment which has been described under the head of local septic infection must be carried out. Curetting is, however, inadvisable, as its only result would probably be to dislodge a fresh shower of infected emboli. The use of ergot is advisable, as, by promoting uterine contractions, it may tend to check the extension of infection. If metastatic abscesses form in joints, they must be opened and drained as soon as possible, in order to save the joint from destruction. If they form beneath the skin or muscles, they may be allowed to point before they are opened. Purulent effusions into any of the serous cavities must be drained, and septic pneumonia and endo- or peri-carditis treated in the usual manner. If the infection is due to streptococci, anti-streptococcic serum may be tried, as its use has occasionally been attended with favourable results. Saline infusions are also of use, if the patient is in a toxæmic condition.

CHAPTER II

DISEASES ASSOCIATED WITH THE PUERPERIUM

Crural Phlebo-thrombosis — The Insanities of Reproduction — Mastitis — Pulmonary Embolus—Sub-involution of the Uterus—Super-involution of the Uterus.

CRURAL PHLEBO-THROMBOSIS

THROMBOSIS of the veins of the leg is by no means an uncommon occurrence after delivery, and may be due to several different causes. In the first place, it may be a simple thrombosis due to the slowness of the circulation of the blood through relaxed veins. The occurrence of such cases is favoured by anything which weakens the heart's action, and by the presence of varicose veins. In some cases the clot may form in the femoral vein, in other cases in the veins of the lower leg. The nearer the heart the thrombosis forms, the greater will be the disturbance of the venous system of the affected leg, and the more marked the symptoms. In the second place, the thrombosis may be due to an inflammation of the inner coat of the vein. In the majority of cases, this phlebitis is the result of direct extension of infection along the walls of the vein from previously infected uterine sinuses. In a small proportion of cases, however, the phlebitis is localised and is apparently not continuous with an infection in the uterine sinuses or pelvic veins. The ætiology of such cases is extremely obscure, but, it is probable that they are due to the irritation of the walls of the vein by the toxins of infecting organisms. In a certain proportion of cases, the lymph channels are obstructed as well as the veins, or perhaps may be alone obstructed. Such an obstruction may arise from the extension of a lymphangitis from the pelvic lymphatics, or may be perhaps due to the compression of the main pelvic lymph channels by already thrombosed pelvic veins. Cases of lymphatic obstruction are probably always of infective origin, and are now not so commonly seen as they were formerly.

Varieties.—From the foregoing we see that phlebo-thrombosis of the leg occurs in two distinct varieties:—

(1) A primary and simple form, the result of slowness of the circulation through the veins.

(2) A secondary and septic form, the result of the extension of infection from the uterus along the walls of the vein, or of the irritation of the inner coat by toxic substances circulating in the blood. In this form, there may be an accompanying obstruction to the lymph channels.

Symptoms.—The symptoms common to all forms of venous obstruction are pain and swelling of the legs, in proportion to the size and situation of the obstructed vessel. If the femoral vein is blocked, the swelling of the leg is very considerable, while if only a few small veins in the calf are obstructed there is only a little œdema in the neighbourhood of the ankle. The thrombosed veins, if superficial, can be felt as knotty cords beneath the skin. In the secondary septic form, pain as a rule precedes the swelling. It may start in the groin and then extend down the leg along the course of the infected veins, or it may be referred to a particular place on the thigh or calf. The leg is extremely tender to the touch, particularly over the infected vein. In some cases, localised areas of inflammation may appear along the course of the vein and subsequently break down into abscesses, or the position of the affected veins may be indicated by lines of slight inflammation, running down the thigh. In the condition known as *phlegmasia alba dolens*, or white leg, in which the lymphatics are affected and probably the veins also, the leg may become of an enormous size, the skin is stretched and is white and glistening, and the pain is intense. If the engorgement is due to the obstruction of the lymphatics alone, the tissues of the leg have a peculiar brawny feel and will not pit upon pressure. If, on the other hand, there is also venous obstruction, the tissues are œdematous and pit on pressure.

In the primary form, there is little or no constitutional disturbance other than that due to the weakness of the patient. In the septic form, on the other hand, there are usually all the evidences of septic infection of a varying intensity. In some cases the symptoms may point to the presence of a septic endometritis or parametritis, in other cases to the existence of a pyæmic condition, while in a few cases there may be no definite signs of infection until the presence of thrombosis shows that it must have occurred.

Treatment.—The three main points in the treatment of each form of thrombosis are rest in bed with the leg elevated, regulation of the bowels, and the administration of abundance of easily digested nourishment. Iron may also be given and strychnine if the heart is weak. The leg must be carefully protected, particularly in phlegmasia, from the pressure of the clothes, as in some cases even the slightest touch aggravates the pain. Some relief will be given by wrapping the leg in cotton-wool, and keeping the latter moistened with evaporating lead lotion. In septic forms, where there are localised areas of inflammation, the use of hot antiseptic compresses is preferable. In all cases, sudden movements must be avoided, and in no case may friction of the leg be employed on account of the danger of detaching a clot. If abscesses form, they must be opened. Constitutional symptoms due to the infection must be treated as has been already described. The patient must not be allowed to leave her bed for at least ten days after fever, pain, and swelling have disappeared. It may, however, be expected that, as soon as she commences to walk on the leg, some pain and swelling will return owing to the uninjured veins not being as yet large enough to carry on the circulation when the woman is in the erect position. Indeed, it is probable that according to the size of the obstructed vessels it will be several months or a year before she is free from all pain, and, for many years after, the pain and swelling will return to a slight extent after prolonged walking or standing.

THE INSANITIES OF REPRODUCTION

The strain thrown by pregnancy and parturition on the maternal organism is, as we have already mentioned, a frequent source of minor psychical abnormalities, and, consequently, it is not strange that, in those whose nervous system is weak or hyperirritable, it may lead to complete mental breakdown. Insanity of such an origin may occur during pregnancy, the puerperium, or lactation; and, since the type met with at each of these periods differs to some extent, and has its own characteristics, it is convenient to make these periods the basis of a classification, the puerperium being assumed to commence with labour and to end six weeks later. Roughly speaking, insanity occurs at least once in every three hundred births, and composes from seven to ten per cent. of all cases of mental disease in females.

THE INSANITY OF PREGNANCY.

Insanity during pregnancy is a rare occurrence, and only accounts for one to two per cent. of all female cases in asylums, though mild cases which do not require special treatment are more common. A neurotic diathesis is present in a large proportion of instances, while previous nervous or mental illness, organic disease, alcoholism, and moral factors such as illegitimacy and desertion also constitute predisposing influences. Insanity is most prone to occur during first pregnancies, especially if these occur late in life or in unmarried women, and, if the pregnancy is associated with severe bodily strain, there is a greater likelihood of the development of mental trouble. The direct causes are partly nervous and partly hæmic in origin. The nervous causes include mental and bodily discomfort and other sources of reflex irritation, and the increased irritability of the nerve centres; while it has been suggested that the altered condition of the blood may consist in a deficiency of phosphoretted bodies of the lecithin group, resulting from the demands made by the growing nervous system of the fœtus.*

Symptoms and Course.—The onset of insanity is usually gradual. If the attack begins before the fourth month, it is milder in character than when it starts later, and presents symptoms more like an exaggeration of the longings and fears common at this period. In such cases, the attack as a rule begins at the time when other disturbances, such as neuralgia and morning sickness, commonly set in. The patient begins to show a nervous timidity and suspicion, with dread of impending misfortune. She is apathetic and depressed, given to self-accusation, distrustful of her husband and relatives, and may show dislike to her children and even try to kill them, while suicide is always to be feared. Her depression may be acute, though this is unusual, and, in exhausted patients, the attack may assume a maniacal form.

Insanity commencing in the later months is more common and more severe, and is usually melancholic in type. It commences like the earlier attacks, but rapidly passes into acute depression, accompanied by sleeplessness, incoherence, delusions and hallucinations which are of an unpleasant and often terrifying nature, and which frequently take the form of hypochondriacal ideas or suspicions of poisoning. There is a strong suicidal tendency, and the patient is often violent and even homicidal. A considerable number of cases are maniacal in character, the mania being of the ordinary type, or hysterical, or delirious, but even then the delusions are frequently terrifying. During convalescence, the patients often pass through a stage of mischievousness and viciousness. In unfavourable cases, the progress to dementia is likely to be rapid. Chronic delusional insanity, general paralysis, and the group of symptoms known as *katatonia*, have also been known to start at this period. The last named is characterised by a stage of melancholia followed by one of alternating excitement and stupor, with delusions and certain peculiar psycho-motor disturbances, and ending in a dementia marked by absence of judgment and emotion, perception and memory persisting for a time.

Treatment.—Freedom from worry, fresh air and moderate exercise, good food, regulation of the bowels, and sleep are the essentials of treatment at all stages, and the patient should be separated from her husband and relatives. Constant watching to guard against suicide is necessary throughout. In the late cases, it is usually necessary to send the patient to an asylum, unless careful nursing and frequent medical supervision can be provided at home. The induction of abortion or premature labour is risky and rarely justifiable. The use of opium should be avoided, but

* F. W. Mott, *Trans. Obstet Soc. Lond*, vol. xlv, p 31.

small doses of chloral and bromides may be given if necessary. Simple tonics, and especially the glycero-phosphates, free phosphorus, or lecithin (from three to five grains in the day) are indicated, but, for the sake of the child, as few drugs as possible should be used.

Prognosis.—From a half to two-thirds of all patients recover, and but few die as a direct consequence of the attack. In the early cases, recovery often occurs at the period of quickening, and usually takes place before the end of pregnancy. In the late cases, it may occur soon after confinement, but many cases pass into puerperal insanity. Most recoveries are complete within six months. The risk of recurrence in subsequent pregnancies is great, and the outlook for the mental condition of the infant is gloomy. In general paralysis, the downward course becomes less rapid after delivery.

THE INSANITY OF THE PUERPERIUM.

Puerperal insanity constitutes about five per cent. of all mental disease in women, and occurs about once in every 400 to 500 confinements. Neurotic heredity is frequent, and previous nervous or mental illnesses, worry, ill-health during pregnancy, organic disease, and alcoholism, also predispose to its occurrence. Other causes are to be found in first confinements, especially when late in life, illegitimacy, prolonged labour, the excessive use of anæsthetics, post-partum hæmorrhage, acute febrile diseases, and above all sepsis. The immediate causes may be the ordinary stress of labour, the reflex changes and awakening of maternal instincts which accompany it, and the absorption of toxins and of the effete products of involution; moreover, sudden grief or nervous shock during or shortly after parturition often starts an attack. It is improbable that all cases are toxic, though the form of the disease is characteristic of toxic insanity.

Symptoms and Course. — Uncontrollable maniacal excitement sometimes comes on suddenly during labour, and usually ceases as suddenly after delivery. There is also a rare ephemeral mania or delirium, which begins during the first three days of the puerperium with rapid pulse, tremulous tongue, tender breasts, and constipation, and passes off as lactation is established and the free action of the bowels is obtained.

Ordinary puerperal insanity appears, as a rule, a little later than this, about half the cases occurring within the first week. Its onset is sudden, and, if the insanity is of septic origin, is accompanied by a rigor. The attack usually assumes the form of a very acute mania, and this is the more acute the earlier the attack commences. The patient becomes dull and depressed, loses interest in her child and surroundings, and suffers from vague groundless fears, headache, insomnia, and loss of appetite. From this state she passes into one of feverish restlessness, and becomes discontented, suspicious, and exacting, and shows dislike to her husband, the attendants, and her child, whom she may try to kill. Her face becomes haggard, her eyes bright, her lips and tongue dry, her pulse weak, and her temperature often rises above 100° F. In septic cases, the uterus may be tender and the lochia fœtid, or, when the infection is most acute, all local symptoms may be absent. The patient mistakes her identity and that of those about her, is generally confused, and has delusions of suspicion, especially of poisoning, and hallucinations, which are usually auditory. She refuses her food, and may be erotic and indecent in word and gesture, and at the same time may show religious exaltation. Finally, especially in septic cases, she may pass into a state of uncontrollable and restless violence, in which she is sleepless, incoherent, and dirty, refuses all food, and looks sallow and anæmic. Her tongue is furred and dry, sordes accumulate on the lips and teeth, her pulse is weak, and sometimes her temperature is high. If the blood is examined, there is found to be an actual diminution in the amount of hæmoglobin. Many cases are suicidal. If the case comes early under treatment, some improvement may be seen in a week, and complete recovery may result, though prior to the establishment of convalescence relapses are not uncommon. In many cases, however, there may be no improvement for six to eight weeks, and there is often a stage of apathy or stupor, or of discontent, which may become chronic. Recovery is usually coincident with the re-establishment of menstruation.

In some cases, the excitement is of a melancholic character, with terrifying delusions and hallucinations, resistiveness, and a strong suicidal tendency, but, as a rule, the melancholic cases, of which there are a considerable number, are of a milder type than the maniacal. They usually commence late and run a tedious and prolonged course. Delusional insanity and general paralysis seldom develop after child-birth. Katatonia, on the other hand, is common, according to Kræpelin.*

Treatment.—As preventive measures, the health of patients subject to mental breakdown should receive special care during pregnancy, and every precaution should be taken to ensure an easy and short labour. It is advisable to deliver the fœtus instrumentally, if labour is prolonged, in order to avoid the occurrence of exhaustion; anæsthetics should be administered only if necessary. Afterwards, the patient must be kept absolutely quiet for some days, and sleep and proper action of the bowels secured.

On the first appearance of suspicious symptoms, the infant must be instantly removed, and the patient kept perfectly quiet, and under constant supervision for fear of suicide. Attention must be paid to the breasts, and, if there is evidence of septic infection, it must be treated as its form necessitates. The bowels should be freely opened by means of saline purgatives. The attack may sometimes be cut short at the outset by full doses of chloral or paraldehyde by the mouth or the rectum, so as to secure deep sleep. If these measures fail, the patient should be sent to an asylum without delay, unless skilled nursing and medical attendance is available and the patient's residence is suitably situated. Separation from the husband and children is in all cases essential, and, if there is no improvement within six weeks, the patient should be sent to an asylum. Everything depends on efficient and early treatment, the most important part of which is feeding, and large amounts of liquid nourishment—eggs, milk, beef-tea, strong soups, plasmon, and the like, with cod-liver oil or malt extract—must be given every few hours, both night and day, if necessary by the nasal or mouth tube. Malt liquors are particularly useful, and may be taken in large quantities. As purgatives, repeated and full doses of calomel, jalap, or even croton oil are well borne, and should be given if necessary. In order to induce sleep, paraldehyde, chloral with bromide, or sulphonal if there is much excitement, may be tried, but the use of opium or hyoscine must be avoided. To relieve restlessness, sponging, the wet pack, and prolonged warm baths are useful. If the temperature is high, from ten to fifteen grains of quinine should be administered every few hours, and in cases of septic infection due to the streptococcus, antistreptococcic serum may be tried. When the stage of excitement is passing off, the patient should spend longer each day in the open air, and, in the later stages, the use of Easton's syrup or a similar tonic and of iron is indicated. Electric baths and the administration of thyroid extract may be tried in the case of depressed and stuporose patients, but these often make good recoveries if allowed to return to their home under supervision. As a rule, marital relations should not be resumed for some months.

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* 'Lectures on Clinical Psychiatry,' ed. Johnstone, pp. 38, 129 *et seq.*

Prognosis.—Seventy-five to eighty per cent. of patients recover, and a few die of exhaustion or sepsis. About half the recoveries are complete within four months, and about ninety per cent. within nine months, but a cure may take place even after several years. Acute and early cases get well quickly. Apathetic and depressed cases and those beginning late are tedious. Recurrence in subsequent confinements is probable, but not invariable. After several recurrences permanent dementia is to be expected, while there is also a tendency to mental breakdown at the climacteric. Albuminuria is an unpromising sign, and so is a return of menstruation when unaccompanied by mental improvement.

THE INSANITY OF LACTATION.

The insanity of lactation forms from three to four per cent. of all cases of mental disease in females. It is essentially an insanity of malnutrition and exhaustion, and chiefly occurs in multiparæ of the poorer classes with a neurotic family history. Previous attacks of insanity, especially of puerperal insanity, frequent pregnancies, prolonged and excessive suckling, hard work and insufficient nourishment, and abnormalities of parturition or of uterine involution are also predisposing causes, while weaning is said to be sometimes the immediate cause. The causation of the earlier cases is similar to that of puerperal insanity, with the addition of exhaustion; of the later cases, exhaustion is the sole cause.

Symptoms and Course.—The earlier cases—namely, those commencing within three months of labour—are usually maniacal, start suddenly, and, in fact, resemble mild puerperal cases. In the later and typical cases, which are of a depressed type, the onset is usually gradual. The first symptoms are those of severe anæmia, accompanied by lassitude, restless irritability, fretfulness, suspicion, and sleeplessness. The patient then develops delusions of impending misfortune, of her own wickedness and her husband's infidelity, of poison in her food, and the like; and hallucinations, usually of hearing, and often of a terrifying character, are very common, as are homicidal and suicidal impulses. The patient is sometimes worse towards evening. In some cases, the condition changes to one of stupor with refusal of food; in others, especially where there is great exhaustion, a period of depression is followed by acute mania, accompanied by confusion, incoherence, violence, and destructiveness; but, in no form are the symptoms so acute as in puerperal insanity. Amenorrhœa is the rule, and, if the menses have returned, they are probably accompanied by excitement and exhaustion. Under proper treatment, all the symptoms gradually subside.

Treatment.—The patient should always be sent away from home, but not necessarily to an asylum, save in the early and acute cases, and especially in the maniacal cases. Good nursing and constant watching are always necessary. The baby must be weaned at once, and the breasts attended to. The bowels must be kept open with laxatives combined with iron, such as aloes and iron pill, and sulphates of iron and magnesium. Change, rest, fresh air, a generous diet which at first may be peptonised, stimulants if required, baths and cold douches to the spine, moderate exercise as recovery progresses, and tonics such as quinine, iron, and arsenic, constitute the treatment. Sedatives are to be avoided as far as possible, and sleep secured by fresh air, exercise, baths, and night-feeding. The use of paraldehyde, bromides, or sulphonal, may sometimes be necessary, and in cases of marked depression, especially if accompanied by agitation, opium may give relief.

Prognosis.—Over seventy per cent. of cases recover, and the death-rate is very small. The average duration is about nine months, but most of the recoveries will be complete within five or six months, and nearly all within eighteen months. Relapses are uncommon.

MASTITIS

Mastitis, or inflammation of the breast, is of relatively common occurrence during the puerperium and during lactation. It is a distinctly preventable affection, as it results from the entrance of pyogenic bacteria into the breast, but, in some cases, it is difficult to trace the source of the infection. The entrance of the pyogenic bacteria is the exciting cause, and the flagging of milk in the breast, or general debility of the patient are the predisposing causes common to all forms of mastitis.

Varieties.—Two forms of mastitis occur—parenchymatous or glandular mastitis, and interstitial mastitis. Parenchymatous mastitis is the term applied to the inflammation of the glandular structures of the breast as distinct from the inter-glandular connective tissue. Interstitial mastitis is the term applied to inflammation of the inter-glandular connective tissue. It is probable that in all severe cases of mastitis the two varieties co-exist, but, in all cases at the commencement of the attack, and in some cases at all times, it is possible to distinguish between them. We shall, therefore, discuss them separately.

PARENCHYMATOUS MASTITIS.—Parenchymatous mastitis, in which the glandular portion of the breast is affected, is the less severe and the more common of the two varieties.

Ætiology.—The cause of parenchymatous mastitis is the entrance of pyogenic bacteria through the milk-ducts of the nipple. As a rule, one or more ducts are affected, the others remaining healthy. The infection extends backwards through the infected ducts into the lobules which they drain. If the case is treated in time, as a rule the infection can be prevented from spreading further, but in some cases it may pass into the interstitial tissue. Anything which predisposes to the decomposition of milk on the nipple, or on the patient's clothes where they are in contact with the nipple, predisposes to the occurrence of mastitis, as the remains of milk furnish a nidus in which bacteria can collect, and from which they can pass into the ducts. Similarly, if the breast becomes 'overstocked,' so that the milk droplets lie for too long in the lactiferous ducts, a suitable nidus is provided inside the breast for the development of the bacteria which have gained entrance.

Symptoms.—The first symptoms of parenchymatous mastitis are a sense of fulness, pain, and heat in the breast. The temperature of the patient usually rises to 100° F., or perhaps a little higher. The tongue is often furred, and the bowels confined. The next day, a triangular patch of inflammation appears on the affected breast. This triangle corresponds to the area drained by the infected duct, its base is situated at the periphery of the breast, its apex at the nipple, and its outline is clearly defined.

In addition to its inflamed appearance, the area is firmer than the rest of the breast and extremely tender. If more than one duct is affected, other similar areas will also be present. The temperature may reach 102° F., and the pulse may attain a rate of 100 to 110. The patient complains of considerable local pain and of general malaise. She may also have had a slight attack of shivering, but we should be inclined to regard such an occurrence as indicative of the passage of the infection beyond the ducts into the interstitial tissue.

INTERSTITIAL MASTITIS.—Interstitial mastitis is a more serious condition than is the variety we have just described, inasmuch as it not uncommonly ends in the formation of an abscess.

Ætiology.—Interstitial mastitis may be the result of the extension of a parenchymatous mastitis from the milk ducts outwards, or it may result from primary infection of the interstitial tissue. In such cases, the infecting bacteria usually gain entrance through cracks in the skin on or round the base of the nipple.

Symptoms.—The initial symptoms of interstitial mastitis are similar to those of parenchymatous mastitis, but usually tend to become more marked. A patch of inflammation appears over the infected area, and differs in appearance from the area of inflammation present in parenchymatous mastitis as it is irregular in shape and ill-defined. On palpation, the infected area is found to be firmer than the remainder of the breast, and to be extremely tender, and, if pus has formed, the covering skin is œdematous, and pits on pressure. In such cases, the temperature of the patient may rise to 103° F. to 104° F., and the pulse become proportionately rapid. The patient both looks and feels very ill, and occasional rigors may occur.

Treatment.—The prophylactic treatment of mastitis consists in preventing the occurrence of cracks or abrasions of the delicate epithelium of the nipple, in the prevention of overstocking of the breast, in keeping the nipple perfectly clean, and in taking care that any necessary manipulations on the part of the nurse or the woman herself are always performed with clean fingers. If proper attention has been paid to the hardening of the skin of the nipple during the end of pregnancy, cracks are unlikely to occur. When the woman has commenced to nurse, a little aseptic lanoline or hazeline cream may be rubbed on the nipples once or twice a day, with the object of keeping the skin soft and elastic. If a crack occurs, it should be healed as quickly as possible and to this end may be touched once or twice very lightly with nitrate of silver, or painted a few times a day with compound tincture of benzoin. If the nipple is very tender, the baby had better nurse at first through a nipple-shield. Overstocking is prevented by regulating the amount of fluid the patient drinks, and by drawing off a small quantity of milk according as is required. Also, if the breast is heavy and tends to become pendulous, it should be supported by means of a handkerchief or bandage round the chest.

The treatment of parenchymatous mastitis, or of interstitial mastitis in an early stage, is directed to preventing an extension of the infection. Nursing should be stopped, at any rate temporarily, both in the interests of the mother and the infant. If the breast is overdistended, it must be emptied with a breast pump. A free purgative should be administered, and the subsequent regulation of the bowels attended to. The breast should be covered with cotton-wool and bandaged as firmly to the chest wall as is possible without causing pain. In a considerable proportion of cases, the symptoms will subside, and as soon as all trace of inflammation has passed away, and the temperature has become normal, the woman may be again allowed to nurse. Even if the milk has temporarily diminished in quantity, it will in most cases again return. If, however, the symptoms of the patient and the appearance of the breast show that pus has formed, it must be evacuated without delay, as every hour that it is left in the breast means a further destruction of the gland.

A mammary abscess, if opened as soon as it forms, and correctly treated, is comparatively easy to cure, while one which has been neglected and is then opened and drained through a small incision is a most tedious condition and may continue to discharge pus for weeks. In all cases, unless the abscess is minute and superficial, the patient must be placed under an anæsthetic, as it is impossible to carry out sufficiently radical measures by means of local anæsthesia. An incision radiating from the nipple and of sufficient length to allow the finger to be passed through it into the cavity, is then made over the most superficial part of the abscess. The pus is allowed to escape, and as soon as it has done so, the finger is introduced into the cavity, and all the septa intervening between the loculi in which the pus is collected, are broken down, so that instead of a number of small cavities one large cavity is formed. This cavity is then curetted out with a large and blunt flushing curette, through which a stream of hot antiseptic lotion is flowing, and all broken down débris removed. As soon as this is done, the cavity is dried, and tightly plugged with iodoform gauze. The breast is then firmly bandaged to the chest wall. The next day the plug is removed, the cavity douched out, and a fresh plug inserted, and this procedure is adopted daily until the temperature falls to normal, and the discharge of pus has almost ceased. As soon as this occurs, the plugging of the cavity may be stopped, a piece of gauze placed in the opening, and the breast firmly bandaged in such a manner as to bring the walls of the cavity into apposition. The breast need not then be dressed for a couple of days, and at the end of that time, it will probably be found that the cavity is almost obliterated, and that only the opening where the gauze was placed is left. The final closure of this opening may be hastened by a stimulating dressing, such as compound tincture of benzoin. It is surprising how rapidly even very bad cases of mammary abscess get well under this treatment, and cases, which under the old treatment of simple incision and drainage would have taken from four to six weeks to cure, are completely healed in from one to two weeks.

PULMONARY EMBOLUS*

Embolism of the pulmonary artery may occur subsequent to delivery in consequence of the detachment of a clot from some part of the venous system and its passage through the right side of the heart into the pulmonary artery. As a rule, the clot forms after delivery in a dilated uterine sinus or in one of the large pelvic veins in which, owing to enfeebling of the heart's action, the blood is circulating slowly. Such clotting is favoured by incomplete retraction of the uterus and the consequent dilatation of the uterine sinuses; by septic infection of the uterine wall extending into the pelvic veins; and by post-partum hæmorrhage, unduly prolonged labour, or other cause of weakening of the heart's action.

Symptoms.—The symptoms of pulmonary embolus occurring during the puerperium are identical with the symptoms to which this condition gives rise at other times. Their onset is extremely rapid. The condition of the patient may be at one moment apparently normal, and then all at once, following perhaps on some slight movement, she becomes collapsed, asphyxiated, her breathing rapid and shallow, and the action of her heart so fast and feeble as to be almost or quite uncountable. If the clot completely fills the main trunk of the artery, death is almost instantaneous, while, if it lodges in the main trunk but does not completely fill it, death may result in from some minutes to some hours. If a branch alone of the artery is plugged, the symptoms are not so severe, and, if the patient survives the first few hours, she may possibly recover.

Treatment.—The patient should be supported in a sitting posture by pillows, as in this position she will breathe most easily. The action of the heart must be stimulated and strengthened by the hypodermic injection of strychnine, and ether. Oxygen, if at hand, should be inhaled. Ammonia is especially recommended, both as a stimulant and on the ground that it may assist the absorption of the clot, or at any rate prevent further thrombosis. It may be given as the carbonate of ammonia in five-grain doses, or as the aromatic spirit, in half-drachm doses, at first every hour, and subsequently less frequently. If the right side of the heart is engorged, as shown by marked cyanosis and fulness of the superficial veins, venesection to the extent of a few ounces, or the application of leeches often gives considerable relief. Such remedies are, however, alone of use where the vessel plugged is of small size; if the main trunk is involved, the prognosis is absolutely bad.

SUB-INVOLUTION OF THE UTERUS

Sub-involution of the uterus is, as the name implies, the condition in which the normal involution of the uterus does not occur, and in which, accordingly, an enlarged and relaxed condition persists long after the organ should have returned to its normal unimpregnated condition. Sub-involution, strictly speaking, is more a gynæcological than an obstetrical condition, but it is customary to refer to it in works on obstetrics.

Ætiology.—The causes of sub-involution may be briefly stated to include anything that predisposes to abnormal and persistent hyperæmia of the uterus during the puerperium. The most common of such conditions are leaving bed too soon after delivery, or too much exercise or work even when the patient has not left her bed prematurely; the presence of a backward displacement of the uterus; the retention of portions of placenta and membranes; and putrid or septic endometritis. Nine-tenths of all cases are probably due to leaving bed too soon and the downward displacement of the heavy uterus, leading to its congestion. It is questionable whether backward displacements should be regarded as the cause or the consequence of sub-involution. In many cases, the displacement is due to the abnormal size of the uterus, and so is the result of the sub-involution; but, in other cases—and we desire to draw attention to the importance of this, backward displacements of the uterus occur without any noticeable symptom of pre-existing sub-involution, and, in such cases, the involution of the uterus usually ceases. The retention of portions of the ovum or the occurrence of endometritis naturally causes congestion. Rarer causes of sub-involution are the presence of tumours such as small myomata, and possibly a very short labour in which the normal degree of retraction of the uterine fibres has not occurred.

Symptoms.—The earliest symptom of sub-involution is the persistence of the lochia beyond the normal period. Later, the symptoms consist in the occurrence of leucorrhœa, in constant backache and bearing-down sensations, and in the presence of an enlarged and soft uterus, which, as a rule, lies lower in the pelvis than it ought to do, and which may be displaced backwards. In any case in which the lochia remain red after the tenth day, or in which the fundus is found above the level of the symphysis after the ninth-day, sub-involution is the probable cause. In estimating the height of the fundus, however, it must be remembered that a loaded rectum or a full bladder may push the uterus into an unduly high position, and so make it appear to be enlarged.

Treatment.—The prophylactic treatment of sub-involution consists in the conduction of the third stage of labour in such a manner that placental fragments are not left behind in the uterus, in attention to the regular emptying of the bladder and rectum during the puerperium, in keeping the patient in bed for a sufficient period after delivery, and in replacing any displacements of the uterus that may occur. Backward displacement of the puerperal uterus may occur without any apparent cause, and is presumably due to undue relaxation of the uterine ligaments. When it does occur it stops involution, but this will again continue if the uterus is replaced. It is, therefore, very essential if the symptoms of the patient point to the existence of a backward displacement to examine her, and, if a displacement is found, to replace it and maintain the uterus in position by tampons which are changed every day, or by a suitable pessary. If a pessary is inserted in such cases, it should be the smallest that will keep the uterus in position. It may usually be removed in a few weeks, as, once involution has occurred, the uterus will remain in its proper position. If, however, the displacement has been allowed to remain uncorrected for weeks or months, the ligaments will have become permanently lengthened, and it will probably be necessary for the patient to wear the pessary for a considerable time.

If sub-involution is present, any causal factor must be removed, and the patient kept in bed. Hot vaginal douches may be administered daily, and, if there is a persistence of red lochia, it is well to wash out the uterus as well. If there is any reason to suspect that fragments of the ovum or decidua have been left behind, the uterus must be explored with the finger or a blunt curette, and the retained fragments removed. In cases in which the lochia still persist, and are principally blood, we have obtained good results by the injection of half a drachm or a drachm of a fifty per cent. solution of formalin. The latter is injected by means of a Braun's syringe, and the uterus immediately washed out with water. All that is desired is to obtain the momentary action of the formalin on the endometrium, and on no account must it be allowed to remain in the uterine cavity, as its caustic action is too great. Formalin causes uterine contraction, and also helps to bring about a healthy condition of the inside of the uterus by hastening the discharge of any remaining fragments of decidua. It may give rise to pain for a few hours after it has been used, due probably to the contractions it induces.

In addition to the use of local measures, ergot may be administered internally. As a rule, it is best to give a few fairly large doses of half a drachm or a drachm of the liquid extract, or a pill containing ergot and strychnine (Strychnine, gr. $\frac{1}{30}$; Ext. Ergotæ, grs. iii.), may be given night and morning for a week.

The future well-being of the patient depends to a very large extent on the due occurrence of normal involution of the uterus, its ligaments, and of the pelvic floor and vagina, and consequently it is to the highest degree important that any failure in that process should be at once determined, and correctly treated.

SUPER-INVOLUTION OF THE UTERUS

Super-involution is the opposite of sub-involution. It is the condition in which the process of involution is carried to too great an extent, with the result that the uterus is reduced to an abnormally small size. It is, in other words, a post-puerperal atrophy of the uterus.

Ætiology.—The usually accepted cause of super-involution is the association of prolonged lactation with a debilitated condition of the woman. Lactation has a well-recognised effect on the occurrence of uterine contraction. At first, every time the infant is put to the breast contractions follow, and it is possible that in some cases the occurrence of such contractions may persist during lactation, and may be largely responsible for the atrophy by unduly limiting the uterine blood-supply. Super-involution may also occur in consequence of the complete or partial destruction of the ovarian structure by inflammatory changes.

Symptoms.—The symptoms of super-involution differ from those of sub-involution in that, while the latter usually appear during the first month or two after delivery, the former do not appear until after a lapse of several months. In all cases, the symptoms are very slight, and are practically limited to the non-appearance of the menses even after lactation has ceased. As a rule, the patient seeks advice on account of her debilitated condition or of the persistence of amenorrhœa, and the atrophy is only discovered accidentally, if a bi-manual examination is made. The uterus in a typical case is reduced to half its normal size, but, in exaggerated cases, it may be considerably smaller than this. Thus, A. R. Simpson described a case in which the cavity was reduced to a quarter of an inch in length. In many instances, the condition is only temporary, and the uterus returns to its normal size as soon as lactation is stopped.

Treatment.—The treatment consists in the improvement of the general health of the patient and in stopping lactation. Plenty of good nourishing food, the administration of iron and cod-liver oil, and change of air, will usually bring about a return to the normal condition. In cases in which the atrophy is due to destruction of the ovaries, and is practically the premature onset of the menopause, treatment, as is to be expected, is of no avail, save in improving the general health of the patient.

PART IX

OBSTETRICAL OPERATIONS

CHAPTER I

VARIOUS OBSTETRICAL OPERATIONS

Accouchement Forcé—Artificial Dilatation of the Cervix by Incision, by Instrumental Dilatation, by Manual Dilatation—Curetting—Induction of Abortion—Induction of Premature Labour; Krause's Method, Podalic Version and Rupture of the Membranes, Tamponade of Vagina, Intra-uterine Injections, Dilatation of the Cervix, Rupture of the Membranes—The Manual Removal of the Placenta—The Suture of Cervical Lacerations—The Suture of Perinæal and Vaginal Lacerations—Tamponade of the Genital Tract.

I. ACCOUCHEMENT FORCÉ

Accouchement forcé is the term applied to the rapid dilatation of the cervical canal to a size sufficient to permit the passage of the fœtus, the performance of podalic version, and the extraction of the fœtus as a pelvic presentation.

Indications.—The indications for *accouchement forcé* cannot be definitely laid down, as they differ to a very great extent according to the teaching of different schools. Some ten to thirty years ago, *accouchement forcé* was a comparatively frequent operation, and was recommended and frequently performed in ante-partum hæmorrhages, in eclampsia, and in other obstetrical complications. In consequence of the high mortality to which it gave rise, the operation then fell into disrepute, and was condemned by many of the highest authorities. Of late, however, in consequence of improvements in its technique, and in a more general appreciation of the necessity for and the means of obtaining asepsis, the operation has been again brought forward, and, so far as we can at present judge, has been adopted with benefit under certain circumstances. Speaking generally, *accouchement forcé* is indicated in certain cases of eclampsia and of grave organic disease of the mother, in which not alone is it considered inadvisable to allow pregnancy to continue, but in which the condition of the patient makes it unwise to wait for the onset of induced labour.

Operation.—The operation consists of three steps:—First, dilatation of the cervix; secondly, podalic version; thirdly, extraction of the fœtus.

Dilatation of the cervix in the classical operation was performed manually, but the use of the fingers for this purpose has been now replaced to a great extent by the class of mechanical dilators of which Bossi's dilator was the first. The method of performing dilatation will be presently described. As soon as the cervical canal is sufficiently dilated to admit the hand, the latter is passed into the uterus, and a foot is grasped and drawn down into the vagina. The method in which the fœtus is extracted will be subsequently described under the heading of extraction in pelvic presentation. The initial steps of bringing the breech through the cervix must be performed slowly and carefully, in order that the cervix may be dilated without laceration. As soon, however, as the umbilicus appears at the vulva, the remaining steps of the extraction must be rapidly performed, as otherwise the fœtus will be asphyxiated during the passage of the head through the pelvis.

ARTIFICIAL DILATATION OF THE CERVIX

Obstetrical dilatation of the cervix, as distinct from gynæcological dilatation, can be effected by one of the following methods:—By incision of the cervix; by instrumental dilatation; and by manual dilatation.

BY INCISION OF THE CERVIX.—Dilatation of the cervix, by means of multiple incisions, was introduced by Dührssen,[*] who says that it constitutes an easy and efficient method of obtaining the necessary dilatation for delivering the fœtus in cases in which the whole supra-vaginal portion of the cervix is already fully dilated, and in which the defective dilatation is limited to the vaginal portion. This condition is usually alone found in primiparæ, in whom the supravaginal portion of the cervix dilates

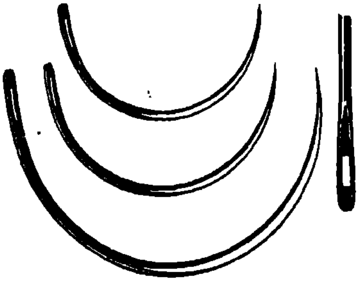

FIG. 385.—MARTIN'S WHOLE-CURVED NEEDLES.

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[*] 'Über den Werth der tiefen Cervix und Scheiden-Damm Einschnitte in der Geburtschülfe,' *Archiv f. Gyn.*, 1890, vol. xxxvii., pp. 27-66.

first. In multiparæ, on the other hand, the supravaginal portion dilates at a later period of labour, and consequently in their case it is rarely possible to perform this operation.

Indications.—Incision of the cervix is indicated in the following cases:—

(1) Stenosis of the vaginal portion of the cervix, which will not yield to the use of sedatives and hot douches.

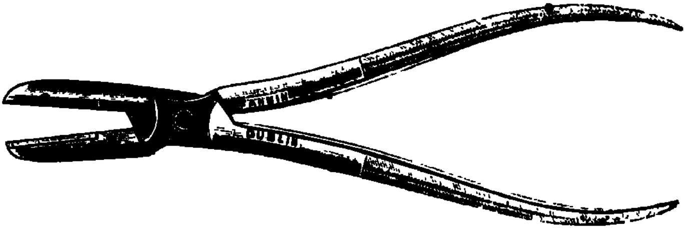

FIG. 386.—MARTIN'S NEEDLE-HOLDER

(2) In cases in which immediate delivery is indicated, in which the supravaginal portion of the cervix is dilated but the vaginal portion is not, and in which dilatation cannot be effected by Frommer's dilator.

Instruments.—The following instruments are necessary:—A posterior speculum; a stout, blunt-pointed scissors; Martin's needle-holder; silk; whole-curved needles of medium and small size; two or three American bullet forceps.

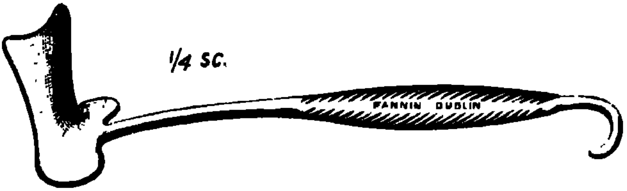

FIG. 387.—A POSTERIOR SPECULUM.

Operation.—The patient is placed in the cross-bed position, and the vagina is thoroughly douched. The posterior margin of the cervix is then seized with two American forceps, one a little to each side of the middle line. The piece of cervix lying between them is then taken between the middle and index fingers of the left hand, the former finger in the vagina, the latter in the cervical canal. The fingers should reach right up to the vaginal insertion. The points of the scissors are then pushed along the fingers, and the cervix divided. Then the lateral margin of the cervix is similarly seized, each side in turn, and divided, and lastly the anterior margin. In cases in which there is extreme rigidity of the cervical tissues from structural change, it may be necessary to make additional incisions between the original four. If so, they are made in a similar manner. Each incision can, as a rule, be made with two cuts of the scissors, and should extend right up to the vaginal insertion.

After the delivery of the child, Dührssen recommends plugging the utero-vaginal canal or the vagina alone, if there is any hæmorrhage, and he does not consider that it is necessary to suture the incisions. We, however, prefer to suture them, in order to avoid a subsequent ectropion. The suturing presents but little difficulty if the cervix is well depressed by traction with forceps and by pressure on the fundus. If it is decided to suture, each incision is closed by two or three sutures passed at right angles to the incisions. These sutures should be removed in ten days.

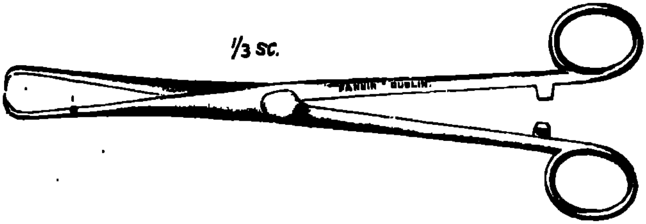

FIG. 388.—AN AMERICAN FORCEPS.

BY INSTRUMENTAL DILATATION.—There are two classes of dilators which are intended for use in obstetrical cases. These are :—

(1) Metal dilators, with four or more eccentric limbs, of which Bossi's dilator is the prototype.

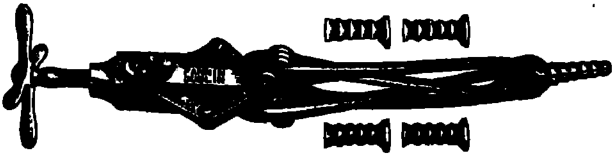

FIG. 389.—BOSSI'S DILATOR, THE BLADES CLOSED.

(2) Hydrostatic dilators, of which Barnes' dilator is the prototype.

One of the best patterns of metal dilator for use in obstetrical practice is Frommer's modification of Bossi's dilator (*v.* Figs. 389-391). As seen in the illustration, it consists of eight limbs, the points of which can be divaricated eccentrically by means of a screw handle. An indicator at the side shows the exact degree of dilatation which has been obtained. The limbs of the instrument are all detachable, and can be readily cleaned. The presence of eight limbs prevents undue pressure on the cervix at any point, and enables the cervix to be dilated gradually and without laceration. For this reason, it has a manifest advantage over Bossi's dilator, which has only four limbs. The instrument is as yet too new to pronounce definitely for or against its use, but judging solely from a mechanical point of view, and from the published results of cases treated by it, it appears to be very perfect, and to have most successfully carried out the object for which it was designed.

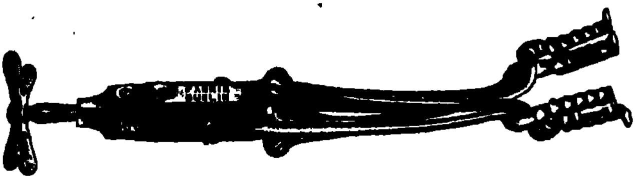

FIG. 390.—BOSSI'S DILATOR, THE BLADES PARTLY OPEN.

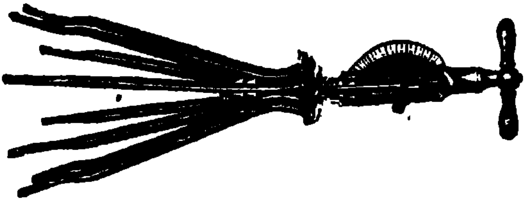

FIG. 391.—FROMMER'S DILATOR, THE BLADES OPEN.

The most recent pattern of dilator is that introduced by De Seigneux (*v.* Fig. 392). It differs from its predecessors in three respects. First, that the dilating part of each blade is set at an angle to the remainder of the blade. Secondly, that sets of blades of different sizes can be adjusted to the same handle. Thirdly, that the blades can be introduced separately.

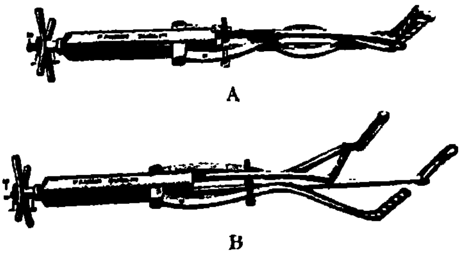

FIG. 392.—DE SEIGNEUX'S DILATOR.
A, The blades closed; B, the blades open.

De Seigneux states that the advantages of his dilator are as follows:—

(1) It is possible to adapt to the same handle, according to the progress of dilatation, a succession of blades of wider surface in such a way as to reduce to a minimum the risk of laceration of the cervix.

(2) Owing to the fact that the dilatation is effected in a plane parallel to the axis of the instrument, the dilator presents a pelvic curve in the obstetrical sense of the word, and so it is possible to bring the dilating part of the instrument into the plane of the pelvic inlet. In consequence, the uterine orifice undergoes no dislocation.

(3) The instrument is so constructed that each blade can be introduced separately, and can be fixed to the handle when it is in position. This permits the use of larger blades than those which are employed in the Bossi dilator and other instruments of the same kind. De Seigneux has a series of blades for his own use varying from 0·6 cm., 1·2 cm., 2·4 cm., 3·6 cm. in width.

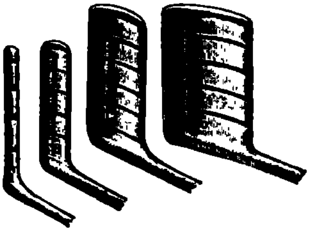

FIG. 393.—THE DILATING PORTION OF THE BLADES, SHOWING THE RELATIVE SIZES OF THE DIFFERENT SETS.

The points of the blades measure respectively in width:—A, 0·6 cm., or ¼ inch; B, 1·2 cm., or ½ inch; C, 2·4 cm., or 1 inch; D, 3·6 cm., or 1½ inches.

(4) As soon as dilatation has been effected, the blades can be withdrawn one after the other, and so the removal of the instrument cannot be obstructed by the descent of the head during the operation.

The following are stated to be the advantages of dilators of the Bossi type:—

(1) They can be applied in the case of a cervix in which neither dilatation nor taking up has commenced.

(2) They enable a sufficient degree of dilatation to be obtained to permit the delivery of a full-term fœtus.

(3) They enable this degree of dilatation to be obtained rapidly, if necessary in from fifteen to twenty minutes.

(4) They excite uterine contractions, even in a uterus suffering from inertia.

Two forms of hydrostatic dilator are in general use—Champetier de Ribes', and Barnes'. The former of these is preferable, inasmuch as the manipulations necessary for its use are less than in the case of Barnes' dilators. Champetier de Ribes' hydrostatic dilator consists of a conical bag made of inelastic water-proofed silk (*v.* Fig. 394). The base of the bag measures three and a half inches, and the bag tapers through a length of six inches to a diameter of half an inch. It is slightly curved to suit the curve of the genital canal, and its fluid capacity is about twenty-two ounces. Barnes' hydrostatic dilators are fiddle-shaped rubber bags of varying size, the smallest of which is introduced first, followed in turn by the others according as the os dilates (*v.* Fig. 395).

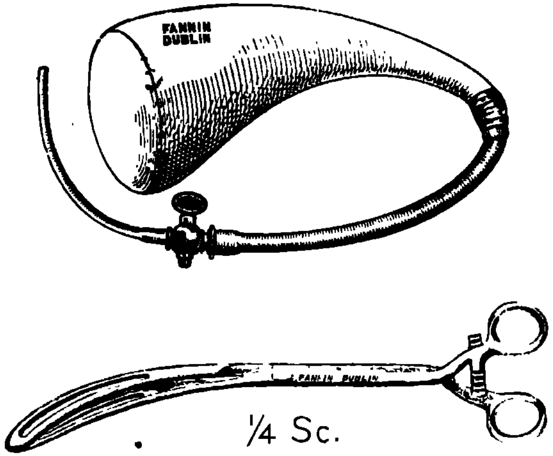

FIG. 394.—CHAMPETIER DE RIBES' HYDROSTATIC DILATOR, AND FORCEPS FOR INSERTING IT.

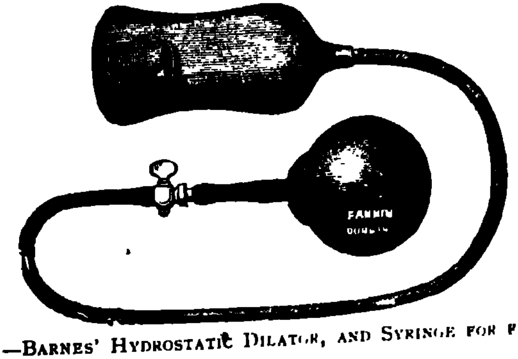

FIG. 395.—BARNES' HYDROSTATIC DILATOR, AND SYRINGE FOR FILLING IT.

Indications.—Instrumental dilatation of the cervix is indicated in the following conditions:—

(1) In cases of pelvic contraction, when, owing to the early rupture of the membranes and the slow advance of the presenting part, the cervix is not dilating, and when delivery *per vaginam* is possible.

(2) In cases of stenosis of the cervix which will not yield to the use of sedatives and hot douches.

(3) In certain complications of pregnancy and labour when it is desired to effect rapid delivery. Amongst these complications may be mentioned certain cases of eclampsia, concealed accidental hæmorrhage, grave renal, pulmonary, or cardiac complications, and the presence of a dead and putrid fœtus.

(4) Champetier's dilator is recommended in certain cases of placenta prævia (Dührssen, Blacker). We do not recommend its general use for this purpose.

Instruments.—If Frommer's dilator is used, no other instrument is required. If Champetier de Ribes' dilator is used, a slightly curved narrow bladed and fenestrated forceps, for introducing the dilator, is also required.

Operation.—The patient is placed in the dorsal cross-bed position, and the vagina is thoroughly douched. If Frommer's dilator is used, it is passed closed through the cervical canal, and then by turning the handle the blades are very slowly and gradually divaricated. After each quarter or half turn of the handle, a couple of minutes' interval should be allowed, and the entire process of dilatation, in cases in which the os was completely closed, should take from thirty minutes to an hour. During the process of dilatation, the vagina should be douched from time to time with hot lysol lotion, as this tends to increase the softness and dilatability of the cervical tissues. [illegible]

If Champetier's dilator is used, it is first sterilised by boiling, then folded along its long axis, caught in the forceps, and passed gently upwards through the uterine orifice. If the orifice is not of sufficient size to permit of the introduction of the forceps, it must be previously dilated with Hegar's dilators. If the uterine orifice is of sufficient size, it is advisable to pass the tips of the fingers through the orifice, and to guide the forceps in between them. The bag should penetrate from four to four and a half inches (10 to 11 cms.) within the internal os. The douche is then attached to the nozzle of the dilator and allowed to flow, taking care that there is a sufficient head of water. As the dilator fills, the forceps is gradually opened, and is withdrawn as soon as the dilator is of sufficient size to prevent the latter from being drawn out along with it. If sufficient pressure cannot be obtained to make the water flow, a new Higginson's syringe must be used. It is best to use a one per cent. solution of carbolic acid in water for filling the dilator. According to the inventor, if 22·4 ounces are injected into the dilator, the latter has a maximum circumference of

13 inches (33 cms.); if 18·9 ounces are injected, of 10·6 inches (27 cms.); if 15·4 ounces are introduced, of 8·7 inches (22 cms.). As the circumference of the full-term fœtal head is about thirteen inches, it will be seen that in vertex presentations the dilator will require to be filled to almost its full extent. As soon as the uterine orifice is of sufficient size, the dilator is expelled by the uterine contractions.

By Manual Dilatation.—Manual dilatation of the cervix is the oldest method in use, and, though in the majority of cases it has been replaced by mechanical dilators, still it sometimes may be found of advantage, especially in view of the fact that no special apparatus is required. The usual method of carrying it out consists in placing the patient in the dorsal cross-bed position, and in introducing first the index finger into the cervix, then the index and middle finger, then three fingers, then four fingers, and finally the entire hand, which is passed gently upwards through the

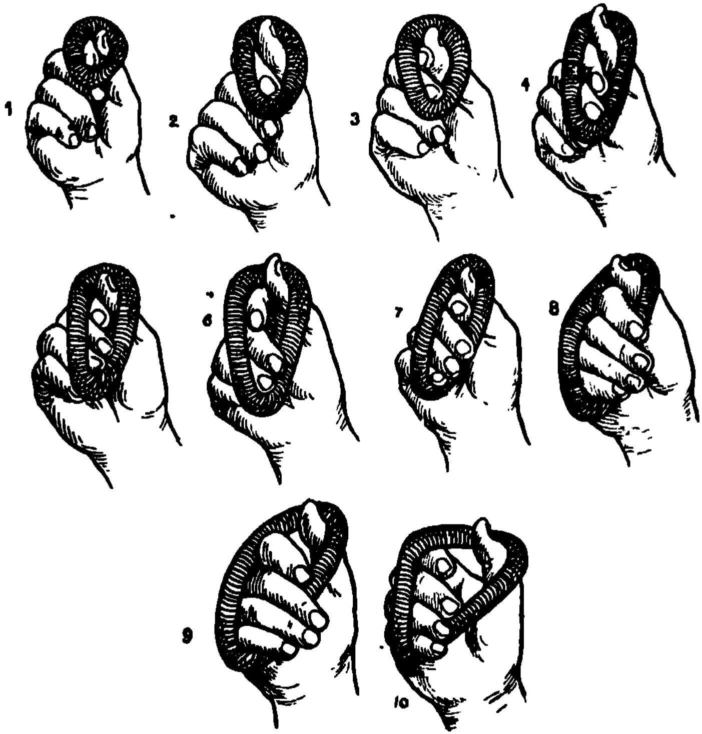

Fig. 396.—The Different Stages in Harris' Method of Manual Dilatation of the Cervix. (Harris.)

uterine orifice in the form of a cone. In each case, room for the additional finger is made by forcibly separating the fingers which have already been introduced. A modification of this method has been introduced by Harris,* and appears to offer certain advantages. Whitridge Williams strongly advocates it and considers it preferable to the use of instrumental or hydrostatic dilators. To perform it, the hand lubricated with lysol, or some aseptic lubricant, is introduced into the vagina, and the index finger pushed upwards through the internal os. Then the index and second fingers are passed into the cervical canal and gradually pushed through the inner os, which is correspondingly dilated (*v.* Fig. 396). As soon as this has been done, the remainder of dilatation is said to be comparatively easy. The index finger and the thumb are passed through the inner os, and forcibly separated from one another by a movement similar to that made when 'snapping' the fingers. This done, the thumb and the index and middle fingers are introduced, and the thumb and fingers again separated in the same manner. Then the thumb and three fingers, and finally the thumb and four fingers are successively introduced. The method is clearly shown in the accompanying drawings. According to Williams, when the internal os is obliterated, dilatation of the remainder of the uterine orifice can be effected in a few minutes by this method, and, in suitable cases, when the internal os only admits the tip of the index-finger dilatation can be effected within half an hour. He, however, considers that if labour has not set in and the cervix is hard and rigid, the exertion of an undue amount of force may be necessary, and may result in deep cervical lacerations. He therefore thinks this method is contra-indicated in such cases.

In all cases of dilatation, the use of an anæsthetic will be probably necessary, and the most careful attention to asepsis is essential. The latter is particularly required in performing manual dilatation in consequence of the length of time during which the fingers must be kept in the vagina and cervix.

In addition to these two methods of obtaining dilatation of the cervix, two other methods in common use in gynæcological practice may sometimes be required in obstetrical practice. These are rapid dilatation of the cervix by means of Hegar's graduated dilators, and gradual dilatation by means of sea-tangle tents. As these methods are fully described in gynæcological text-books, we do not consider it necessary to describe them here.

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* 'A Method of Performing Rapid Dilatation of the Os Uteri,' *American Journal of Obstetrics*, 1894, pp. 37-49.

CURETTING

The operation of curetting is occasionally required in obstetrical practice for the purpose of completely emptying a uterus in which portions of an ovum have been left behind.

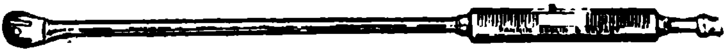

FIG. 397.—RHEINSTADTER'S FLUSHING CURETTE.

Indications.—Curetting is indicated under the following conditions:—

(1) Certain cases of threatened abortion accompanied by hæmorrhage, and of incomplete abortion, in which the ovum cannot be expressed or removed by the finger.

(2) Certain cases of hydatidiform mole.

(3) All cases of putrid endometritis associated with the retention of fragments of placenta or membranes.

(4) Certain cases of secondary post-partum hæmorrhage due to the retention of small portions of placenta or membranes, which cannot be removed with the finger.

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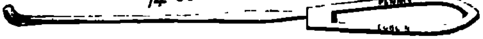

FIG. 398.—HEGAR'S SHARP CURETTE.

Instruments.—The following instruments are required:—a posterior speculum; two American forceps; Rheinstadter's flushing curette, or other form of blunt curette; Bozemann's double-channel catheter.

Operation.—The patient is placed in the dorsal cross-bed position, and, after preliminary disinfection of the vulva and vagina, a speculum is introduced, and the cervix exposed, caught by a forceps on the anterior lip and drawn down. The uterus is then washed out, and the flushing curette attached to the douche tube is introduced into the uterus and passed gently upwards to the fundus, in order to ascertain the length of the uterus. The uterus is then curetted in the usual manner, the curette travelling from the fundus to the inner os, and gradually going all round the uterus. The force with which it is pressed against the uterine wall must be graduated according to the degree of softness of the uterine tissue, and should be only just strong enough to remove any placental or other fragments projecting from the wall. In the case of a very soft uterus, it is an easy matter to push the curette through the uterine wall, and also, in the case of a puerperal uterus, it is quite possible to scrape away portions of the muscular coat. If the curetting is followed by hæmorrhage, the uterine cavity may be plugged with iodoform gauze, and the same course may with advantage be adopted in cases of putrid endometritis. In the former case, the gauze may be allowed to remain *in situ* for twelve to twenty-four hours. In the latter case, it must not remain for more than twelve hours.

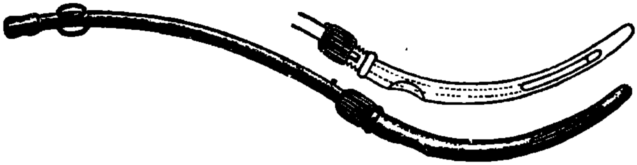

FIG. 399.—BOZEMANN'S DOUBLE-CHANNELLED CATHETER.

THE INDUCTION OF ABORTION

The term induction of abortion is applied to the bringing on of labour before the fœtus is viable, *i.e.*, before the 28th week. It must be understood that the term is only applicable in cases in which, but for the intervention, pregnancy would have continued to term, and that it is not applicable to cases in which the uterus is emptied in consequence of the presence of a dead ovum or of hæmorrhage. It is advisable to remember this, as the operation is one of importance for ethical and sociological reasons, and, as such, differs from the emptying of the uterus in cases in which the ovum is dead or certain to be dead in a short time. The induction of abortion, unless necessitated by conditions which threaten the life of the patient, is a procedure contrary to both the civil and the moral law, and so is always open to adverse criticism, whereas the removal of an 'inevitable abortion' is contrary to neither law, and is a procedure the permissibility of which has never been called in question. Some writers have improperly termed the latter operation 'the induction of abortion,' and hence we consider it advisable to clearly differentiate between the two.

Indications.—The induction of abortion is never indicated, save in order to preserve the life of the mother, and in no case should a medical man perform it solely on his own responsibility. If he considers the procedure necessary, he should for his own protection insist on a consultation in order that he may be supported by the opinion of another medical man. The cases in which the procedure is indicated may be divided into three groups:—

(1) Certain cases of displacement of the pregnant uterus in which the displacement cannot be corrected, and which cannot go to full term. Such cases are:—

(*a*) Irreplaceable incarceration of the retroverted pregnant uterus.

(*b*) Irreducible prolapse of the pregnant uterus.

(*c*) Irreducible hernia of the pregnant uterus. In almost all such cases, however, the uterus can be replaced by the adoption of suitable operative procedures.

(2) Certain diseases of or accompanying pregnancy, which do not respond to treatment and which threaten the life of the patient. The most important of these diseases are hyperemesis, profound auto-intoxication, and certain cases of serious organic disease.

(3) Certain cases of narrowing of the parturient canal to such a degree that the passage of a viable fœtus is impossible. The principal causes of such narrowing are contracted pelvis, bony or malignant tumours blocking the pelvis, and extreme cicatrisation of the vagina or cervix. This group was in the past a usual indication for the induction of abortion, but now, owing to the improved technique of Cæsarean section, it is seldom regarded as an indication.

Instruments.—If the cervix is to be dilated and the ovum removed, the following instruments are required: a posterior speculum, two American forceps, sea-tangle tents, Hegar's dilators, Bozemann's catheter, and a flushing curette. If labour is to be induced, a couple of sterile gum-elastic bougies are required.

Operation.—If the operation has to be performed prior to the formation of the placenta, *i.e.*, before the fourth month, the simplest method consists in dilating the cervix and removing the ovum with the finger. In order to do this, preliminary dilatation of the cervix must be effected by the introduction of sea-tangle tents for twenty-four or forty-eight hours, then dilatation completed, by means of Hegar's dilators, up to the size necessary to admit two fingers, and then the finger introduced and the ovum detached and expressed. If any fragments are left behind, the uterus may be gently curetted with a flushing curette.

If the operation has to be performed after the formation of the placenta, but while the ovum is still small, *i.e.*, from the fourth to the sixth month, the best and safest method consists in puncturing the membranes with a stylette after a slight degree of initial dilatation of the cervix with Hegar's dilators. The liquor amnii will then escape, and this will be sufficient to provoke the onset of labour. After the sixth month, abortion will be best induced by Krause's method, as in the case of premature labour.

THE INDUCTION OF PREMATURE LABOUR

The induction of labour is the term applied to the bringing on of labour after the fœtus has become viable, but before full term. A fœtus is said to be viable after the twenty-eighth week, but in practice a fœtus of less than thirty weeks is so difficult to rear that it can scarcely be considered to be viable. Consequently, as the induction of premature labour is usually performed in order to save the life of the fœtus, it is not as a rule performed before the latter date.

Indications.—The following are the chief indications for the induction of premature labour:—

(1) Certain degrees of contracted pelvis.

(2) The habitual death of the fœtus at a period after it has become viable, save in cases due to syphilis or renal disease.

(3) Certain diseases of or accompanying pregnancy, which threaten the life of the mother, as renal, cardiac, or pulmonary diseases; certain cases of eclampsia, or undue interference with the action of the heart and lungs owing to the excessive size of the uterus, as in hydramnios.

We have already discussed the value of the induction of labour in contracted pelvis, and need not again refer to it save to say that the induction of premature labour is usually indicated in cases of flat pelvis in which the true conjugate measures between 2¾ and 3½ inches, and in generally contracted pelvis in which it measures between 3 and 3¾ inches. In these countries, we think most obstetricians are agreed as to the value of premature labour in such cases, but the fact cannot be overlooked that in other countries many of the highest authorities consider that the interests of the fœtus demand the adoption of other measures. Thus Sänger, Bar, and Whitridge Williams advise Cæsarean section at term as an alternative to the induction of labour in all possible cases, while Pinard believes symphysiotomy to be preferable. Undoubtedly, the fœtal mortality is high after the induction of premature labour, and there is a very perceptible maternal mortality the result of infection, while in competent hands the maternal mortality of Cæsarean section and symphysiotomy is very low. Still, in general practice, the induction of labour possesses great and obvious advantages, and is, we consider, the proper course to adopt in suitable cases. If, however, it fails to save the life of the fœtus in any patient, it is but right that, at a subsequent pregnancy, the advisability of the adoption of other measures should be fully considered.

Methods.—The different methods that have been suggested from time to time of inducing premature labour are numerous. Some are certain but dangerous, others are comparatively safe but uncertain, others still are both unsafe and uncertain, whilst the number that are both comparatively safe and certain is not very great, and there is no method that can be regarded as entirely free from risk. Further, there is no method that is suitable for use in all cases. The following is a brief description of the methods most usually adopted:—

Krause's Method.—Krause's method of catheterisation of the uterus consists in the passage of one or more stout gum-elastic bougies or catheters between the membranes and the uterine wall. It is the method usually adopted in cases in which the sole indication for treatment is to bring on labour pains, and in which there is no necessity for haste. If carried out with strict attention to asepsis, it is comparatively safe, and, if a sufficient number of bougies are introduced, it is tolerably certain. Bougies are preferable to catheters, as it is easier to sterilise them. The operation is performed as follows:—The patient is placed in the dorsal cross-bed position, the vagina douched, a posterior speculum introduced, and the cervix caught and drawn down with an American forceps. The plug of mucus, which is sometimes infected, should be removed from the cervical canal by means of a piece of cotton-wool twisted round a probe, in order that it may not be carried upwards into the uterus. Three or four gum-elastic bougies, which have been sterilised by boiling for ten minutes, or by prolonged soaking in a 1 in 500 solution of corrosive sublimate, are then passed one after another through the internal os, and upwards so far as they will go between the membranes and the uterine wall, without using any undue force. If a bougie meets with much resistance when passed in one direction, it must be withdrawn and passed in another direction, as such resistance is probably caused by the placenta, and, if the latter is wounded, hæmorrhage may follow. The bougies should not lie too close together, as what is desired is to bring about a considerable degree of separation of the membranes. Every care should be taken to avoid rupturing the membranes, as if this occurs it is a distinct misfortune. In some cases, however, it is practically unavoidable, owing to their extreme thinness. As soon as the bougies are in position, a piece of iodoform gauze is wrapped round their vaginal ends, to prevent them from pressing against the vaginal mucous membrane, and the patient is kept quietly in bed. The time at which labour comes on after the introduction of the bougies is very variable. It may occur in a few hours, or it may not occur for several days, and only then when other ancillary measures are adopted. If labour follows within twenty-four hours, the bougies are removed as soon as the contractions are occurring regularly and strongly. If labour does not occur within that time, the bougies must be removed, the vagina well douched, and a fresh set introduced. If three sets are introduced without result, some other method must be adopted, and in such cases the best course is to dilate the cervix *with hydrostatic or other dilators, and if labour pains still do not occur, to turn the fœtus and draw down a leg into the vagina.*

Podalic Version, and Rupture of the Membranes.—*In* order to carry out this method of inducing labour, a sufficient degree of dilatation of the cervix to admit at least two fingers must be present. This degree is usually present in cases of ante-partum hæmorrhage, in which this method of inducing labour is particularly valuable, but in other cases, if podalic version is to be adopted, a preliminary dilatation of the cervix with hydrostatic or other dilators is necessary. With the exception of cases of placenta prævia, this method is only adopted in cases in which Krause's method has failed. Version in these cases is performed by the bipolar method, and as soon as a foot has been brought over the os internum, the membranes are ruptured and the foot drawn down into the vagina. If, as sometimes happens, uterine contractions do not result, they may be excited by gentle and continuous traction applied to the foot in the vagina.

Tamponade of the Vagina.—Tamponade of the vagina, if so performed as to cause firm pressure against the cervix and lower part of the uterus, will as a rule bring on uterine contractions. It is the method usually adopted in cases of accidental hæmorrhage, as it at once checks the hæmorrhage and brings on labour. Williams[*] advises that, as well as plugging the vagina, the cervix be also tightly plugged, and this step is probably of advantage. Some of the gauze may also be passed through the os internum in such a manner as to press upon and detach the membranes covering the lower pole of the ovum. Spineli recommended that the portion of gauze passed into the uterus should be soaked in ichthyol-glycerine. We do not know that any particular advantage is attached to the use of ichthyol, but as glycerine is a direct exciter of contraction in unstriped muscle, its use ought to prove of value.

Intra-uterine Injections.—Cohen recommended some years ago the injection of fluid between the membranes and the uterine wall as a certain means of inducing labour. He advised the use of aqua picis in quantities of from 200 to 300 c.cs. (7 to 10 oz.).[‡] More recently Pelzer[†] suggested the use instead of sterile glycerine, in quantities of 100 c.cs. (3½ oz.). Pelzer claimed that glycerine acted in three ways:—that it caused a mechanical separation of the membranes; that it directly stimulated the uterine fibres to contract; and that by its hygroscopic properties it drew liquor amnii through the membranes, and so rendered them flaccid. There is no doubt that the injection of glycerine quickly causes the onset of uterine contractions, but unfortunately its use is far from safe, as, if used in these quantities and in a manner which apparently permits of its rapid absorption unchanged, glycerine can cause very severe toxic symptoms, and even death. Pfannelstiel[*] called attention to this danger in 1894, and since then other writers have also done so. To meet this objection, Kossman used very much smaller quantities of glycerine, and successfully induced labour by injecting 5 c.cs. (85 minims) of glycerine. He considered that it was quite unnecessary to use glycerine in large quantities for hygroscopic purposes, and that the injection of small quantities with the object of stimulating the muscle fibres, as in the rectum, was sufficient. His results were satisfactory, so far as they went, but in spite of the fact that a safe, certain, and fairly quick means of inducing labour is required, they have not been generally accepted, and further evidence on the use of glycerine is still required.

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[*] *Op. cit.*, p. 346.

[†] 'Über einleitung der künstlichen Frühgeburt,' *Cent. f. Gyn.*, 1892, pp. 35, 36.

Dilatation of the Cervix.—Dilatation of the cervix is not often used alone as a means of inducing labour, but rather as an adjunct to other methods. It is usually adopted when catheterisation of the uterus fails to induce contractions. The different means of effecting dilatation have been described already.

Rupture of the Membranes.—This method, which was introduced by Scheel, is the simplest and the most obvious way of inducing labour, as it is so easily performed. Unfortunately, however, it is not satisfactory on account of its prejudicial effect on the mechanism of labour, and also because the interval between the rupture of the membranes and the start of contractions is very variable. Consequently, its use is limited to cases in which we desire to allow some of the liquor amnii to escape, as in cases in which labour has to be induced in consequence of threatened cardiac failure due to the pressure of a very large uterus.

There are numerous other methods of inducing labour which have been recommended from time to time, but we do not consider that they are of sufficient importance to be described. Amongst them are the following:

(1) Prolonged vaginal douching—Kiwisch's method. This is tedious and uncertain.

(2) The use of electricity. This is most uncertain, and necessitates the employment of apparatus which is seldom at the disposal of the obstetrician.

(3) The use of so-called echolics. It is now generally recognised that there is no drug that will bring on labour unless it is administered in toxic doses. Consequently, this method is not of practical value.

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[*] 'Über die Gefährlichkeit der intraut. Glycerineinspritzung.' *Centralbl f. Gyn.*, 1894, vol. xxix., pp. 37-49.

THE MANUAL REMOVAL OF THE PLACENTA

The manual removal of the placenta has been already described in the sections dealing with retention of the placenta (*v.* Part VII., Chap. IX.).

THE SUTURE OF CERVICAL LACERATIONS

The necessity for suturing cervical lacerations does not often arise, since even if a laceration is present, it is not detected unless it gives rise to hæmorrhage. The practice, which has been occasionally recommended, of examining the cervix in all cases immediately after the expulsion of the placenta, with the object of determining the presence of cervical lacerations, is objectionable in the highest degree on account of the unnecessary manipulations it entails and the attendant risk of infecting the genital tract. Besides, the difficulty of detecting the presence of a laceration is considerable, and the difficulty of determining whether the laceration requires suturing is even greater. Many lacerations which to the examining finger appear to be of large size, will subsequently almost entirely disappear in consequence of uterine involution. We consider that far more benefit will result to the patient from the adoption of a routine examination made from a fortnight to three weeks after delivery, than from an examination made immediately after delivery.

Indications.—Suture of cervical lacerations is indicated in cases of traumatic hæmorrhage from the cervix.

Instruments. — The following instruments are required: — a needle-holder, small curved needles, silk, silk-worm gut, or catgut. It is, however, more easy to suture the laceration if there are also at hand a large posterior speculum and a couple of American forceps; in practice, however, we usually have to work without them.

Operation.—If all the necessary instruments are at hand, a posterior speculum is introduced, the cervix exposed, and the laceration found and drawn into view by two American forceps, one applied to each edge. If, however, as frequently happens, we have neither a speculum nor volsella, an extemporised form of cervical tractor can be made in the following manner:—Thread a small curved needle with a long ligature of number eight or ten silk. Pass two fingers of the left hand into the vagina to touch the most prominent portion or the cervix. Introduce the needle—held in a needle-holder—into the vagina under cover of the fingers of the left hand, and pass it through the cervix. The ends of the ligature are then knotted together, and by traction upon them the cervix can be exposed. The descent of the cervix will be very much facilitated by firm suprapubic pressure upon the fundus. As soon as the source of the hæmorrhage has been exposed, either the bleeding vessel is tied or the laceration sutured. In the latter case, the sutures are passed at right angles to the tear. If the site of the hæmorrhage cannot be found, the bleeding can be stopped by plugging the utero-vaginal canal with iodoform gauze. Cervical sutures inserted with the object of checking hæmorrhage may be removed on the eighth day. If, however, they were inserted with the object of bringing together the edges of a laceration, they may be left *in situ* until the fourteenth day.

THE SUTURE OF PERINÆAL AND VAGINAL LACERATIONS

The suture of perinæal lacerations is the most common operation in obstetrical practice, and on its proper performance the patient's subsequent comfort and well-being greatly depends. The worst perinæal laceration, if kept aseptic and properly sutured, can be healed completely and the perinæum restored to its former condition; while, if it is left unsutured, it will not improbably form the first step in the subsequent occurrence of chronic uterine displacements.

Indications. — Suture of a perinæal or vaginal laceration is necessary in all cases in which the tear extends beyond the posterior commissure.

Instruments. — The instruments required are as follows: — a needle-holder; large and medium-sized whole curved needles; silk, silkworm-gut, or catgut. In the case of extensive laceration of the vaginal mucous membrane, a large posterior vaginal speculum is of use, as it can be used as an anterior speculum and made to expose the posterior vaginal wall by drawing the anterior wall forwards.

Operations.—The perinæum may be sutured at any time after the birth of the infant. Suturing during the third stage, *i.e.*, before the placenta comes away, offers the advantage that at this time the patient is usually still under the influence of the anæsthetic she has had during the stage of expulsion, and even if she has become conscious, the perinæal and vaginal tissues are temporarily analgesic in consequence of the bruising to which they have been subjected. Suture before the expulsion of the placenta, however, possesses the disadvantage that, if the placenta is adherent and has to be removed subsequently, the introduction of the hand may necessitate the removal and re-insertion of the sutures, as, if they are not removed, the tissues may again tear apart. In the case of slight lacerations, however, in which the perinæum alone is involved, and especially in the case of those occurring in primiparæ, in whom placental retention is unlikely to occur, suture may be performed during the third stage. On the other hand, the suturing may be performed immediately after the expulsion of the placenta. If there is any reason to fear placental retention, or if extensive laceration of the vaginal walls necessitates the introduction of intravaginal sutures, it is better to postpone the suture until this period, although it may be necessary to again place the patient under the influence of an anæsthetic.

When the confinement occurs at night, the suturing may be postponed with advantage until the following morning, in order that it may be done with more deliberation, and in better light.

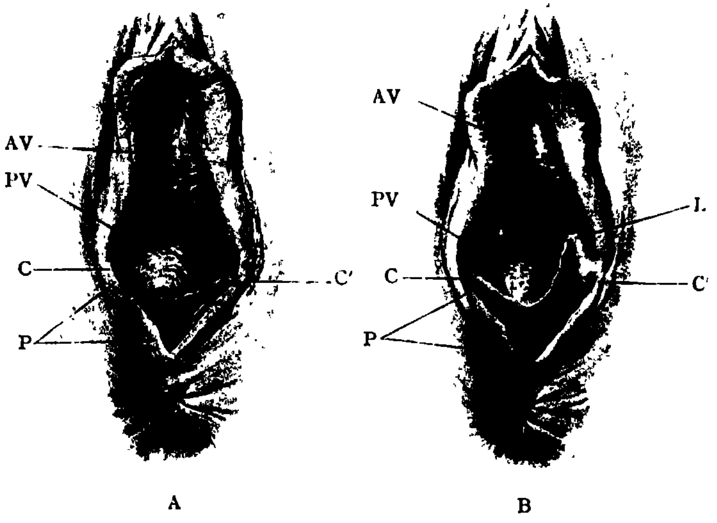

FIG. 400.—PERINÆAL AND VAGINAL LACERATIONS. A, SIMPLE LACERATION OF PERINÆAL BODY; B, PERINÆAL LACERATION AND UNILATERAL VAGINAL LACERATION.

P, Extent of perinæal laceration; C, C′, posterior commissure; L, upper limit of vaginal laceration; PV, posterior vaginal wall; AV, anterior vaginal wall. (Bumm.)

This is an unnecessary course to adopt in the case of small lacerations, but in the case of extensive lacerations, particularly when they involve the rectal wall, it is undoubtedly the proper course, as it offers the best prospect of obtaining a good result. It is often most difficult to suture a complicated laceration in the proper manner when the attempt is made immediately after delivery, as the bad light and the obscuring of the wound by the blood which comes from the uterus render it difficult to bring the torn surfaces into correct coaptation.

As we have already seen, perinæal lacerations can be divided into two classes:—Complete lacerations, in which the tear extends through the rectal wall; and incomplete lacerations, in which the tear involves the perinæal body, the rectal wall remaining intact. Either of these classes may be further complicated by the presence of deep laceration of the posterior vaginal wall, as shown in Figs. 400 and 401. It may, however, be more convenient for our present purpose if, instead of the foregoing classification, we classify lacerations as follows:—

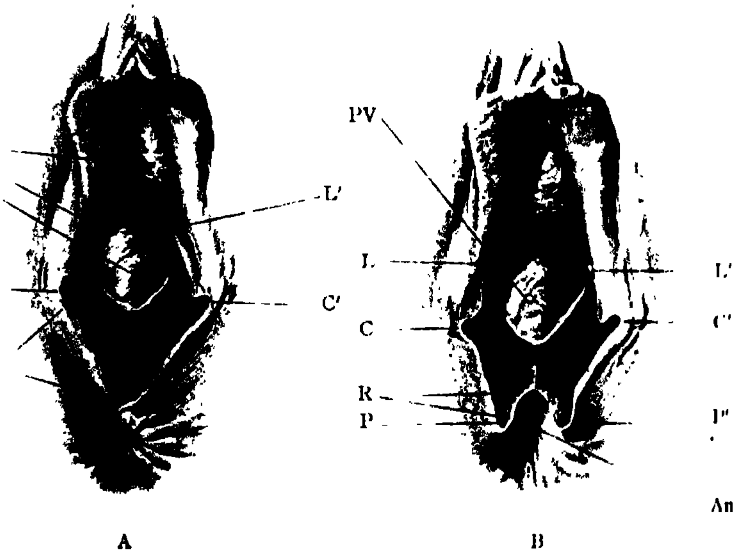

Fig. 401.—Perinæal and Vaginal Lacerations. A, Laceration of Perinæum and Bilateral Laceration of Vagina; B, Laceration of Perinæum, Rectal Wall, and Vaginal Wall.

R, Rectal laceration; An, anus; P, extent of perinæal laceration; P', posterior limit of laceration; C, C', posterior commissure; L, L', upper limits of vaginal laceration; PV, posterior vaginal wall; AV, anterior vaginal wall. (Bumm.)

(1) Laceration of the perinæal body alone.

(2) Laceration of the perinæal body and (*a*) of the rectal wall, (*b*) of the vaginal wall, (*c*) of both rectal and vaginal walls.

If the perinæal body alone is torn, the operation of suturing is an easy one, and can be performed with the patient in either the dorsal or the lateral position. The nature of the laceration is usually as shown in Fig. 400, A, and the object of the sutures is to bring the points C and C' and the raw surfaces posterior to them into contact (*v.* Fig. 402). With this object, two or more sutures, according to the length of the tear, are inserted through the perinæal skin at one edge of the laceration, and passed upwards

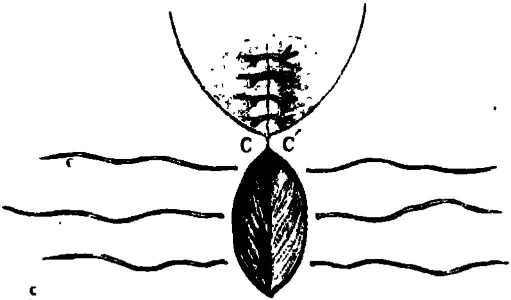

FIG. 402.—THE SUTURE OF A LACERATION OF THE PERINÆUM AND VAGINA. The vaginal sutures are tied; the perinæal sutures are in position. (Bumm.)

beneath the torn surface, on a plane parallel to the rectum, to emerge at a corresponding point on the perinæal skin at the

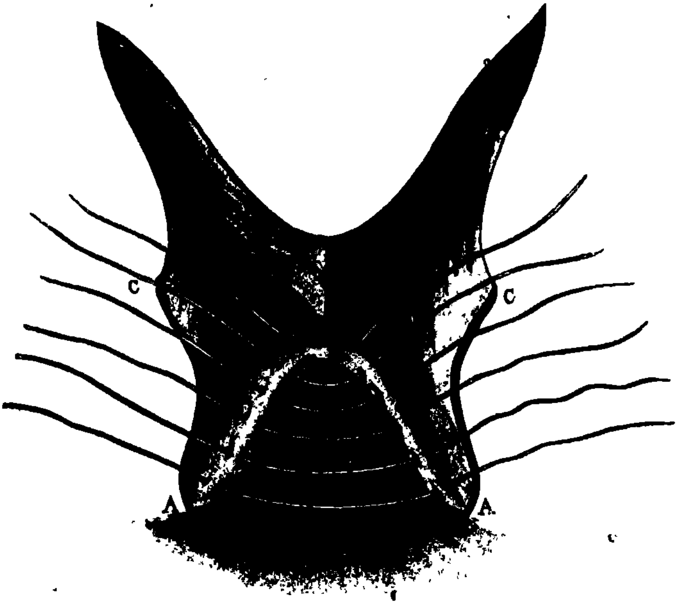

FIG. 403.—THE SUTURE OF A COMPLETE LACERATION OF THE PERINÆUM. The sutures in position in the rectal wall. (Bumm.)

opposite edge of the laceration. The sutures pass completely beneath the laceration, and, when tied, bring the points C and C′

and the edges CP and C'P together. The sutures may be of silk, silkworm gut, or catgut. Silkworm gut is perhaps best on account of the absence of capillarity; but catgut is most convenient, as it does not require to be subsequently removed.

If in addition to the perinæal tear, there is a laceration of the

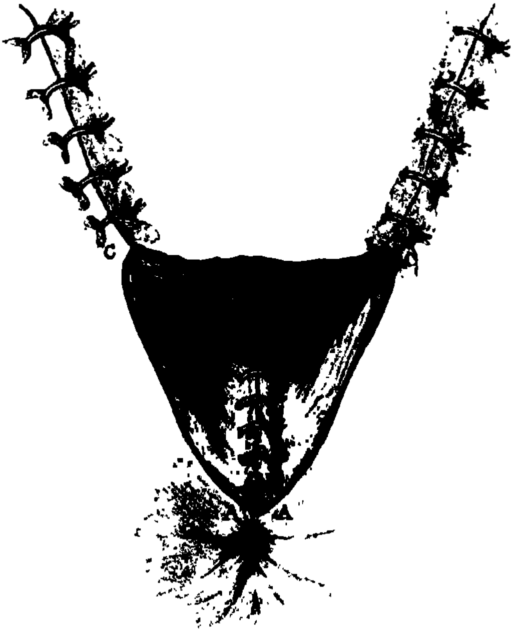

FIG. 404.—THE SUTURE OF A COMPLETE LACERATION OF THE PERINÆUM. The sutures in the rectal and vaginal walls have been tied The perinæal sutures are not yet inserted (Bumm.)

posterior vaginal wall extending upwards in the middle line, or to one side, as shown in Fig. 400, or at both sides, as shown in Fig. 401, before inserting the perinæal sutures, the edges of the vaginal tear must be brought together. To do this satisfactorily, the posterior wall must be exposed. If we have a suitable speculum at hand, it is introduced as an anterior speculum, and draws up the anterior wall. If we have no speculum, a sufficient degree of exposure can usually be obtained by taking a large plug of cotton-wool, which has been sterilised by prolonged immersion in an antiseptic—in default of steam sterilisation—and passing it into the vagina above the upper limits of the tear. This, if of sufficient size, will answer the double purpose of keeping back the anterior wall, and also of temporarily damming up the blood flowing down from the uterus and so preventing it from obscuring the field of operation. The laceration being thus exposed, a small curved needle threaded with catgut is taken, and the edges of the vaginal mucous membrane of each rent are in turn brought together from above downwards. The sutures may be interrupted, as shown in the drawing, or continuous, the latter being more easily and quickly inserted. This being done, the condition is now one of simple laceration of the perinæal body, and this is sutured as already described.

If, on the other hand, the perinæal tear is complicated by an accompanying tear of the rectal wall, either with or without an extensive tear of the vaginal wall, the first step of the operation consists in bringing together the edges of the torn rectal wall. This is best done by a continuous suture passed as shown in the drawing, and commencing above. The suture is introduced from the anterior aspect of the rectal wall, and traverses the thickness of the wall with the exception of the mucous coat (*v.* Fig. 402). If it is thought better, the sutures may be interrupted. These sutures must be of catgut, as they will be subsequently buried when the perinæal sutures are tied. If a vaginal rent also is present, it is next sutured from the vagina as has been described (*v.* Fig. 403), and, finally, the perinæal tear is closed by sutures passed from the skin (*v.* Fig. 401).

After-treatment.—The after-treatment consists in maintaining asepsis, and in keeping the patient quiet. The perinæal wound should be washed with a mild antiseptic lotion two or three times a day, and should be kept as dry as possible. If the lochia are fœtid the vagina should be douched daily, but so long as they are healthy no douching is required. The patient ought not to be allowed to sit up in bed before the tenth day. It is advisable to give a purgative on the evening of the second day, in order to prevent the accumulation of fæces in the rectum. If the sutures used are non-absorbable, they must be removed on the seventh day.

TAMPONADE OF THE GENITAL TRACT

Tamponade, or plugging, of the genital tract is a procedure of considerable value in obstetrical practice, inasmuch as it affords a means of compressing bleeding areas, and so checking hæmorrhage; of stimulating uterine contractions, and so inducing labour; and of bringing an antiseptic into contact with infected areas.

Indications.—The vaginal tampon is indicated before delivery in certain cases of accidental hæmorrhage; it is never indicated subsequent to delivery save in association with a uterine tampon. The uterine or the utero-vaginal tampon is indicated in certain cases of severe post-partum hæmorrhage, in cases of lochio-metra (retention of the lochia in the uterine cavity), in septic or putrid endometritis, and in certain cases of threatened abortion.

Instruments.—The material usually adopted for plugging the uterus is iodoform gauze, but for plugging the vagina in cases of accidental hæmorrhage cotton-wool is perhaps more suitable, as it is possible to introduce a larger quantity of it, and so to more effectually seal the uterine orifice. For tamponing the vagina, a posterior speculum is the only instrument required, and it can be dispensed with. For uterine plugging, a posterior speculum is necessary, especially in cases of threatened abortion. After delivery, it can be more easily dispensed with, but, if at hand, it is of considerable assistance. Two American forceps or other form of volsellum are also required for fixing the cervix, and a plugging forceps, a Bozemann's catheter, or a uterine sound for introducing the gauze.

Operation.—The operation of plugging the vagina in cases of ante-partum hæmorrhage is performed as follows:—Place the patient in the cross-bed position, with her hips well over the edge of the bed. Administer an anæsthetic if necessary, as is usually the case, since the firm application of a plug is rather a painful procedure. Wash the external genitals and douche out the vagina thoroughly. Then, pass a posterior speculum, and, with strips of iodoform gauze soaked in lysol solution (0·5 per cent.), plug tightly round the cervix. A speculum is not necessary, but, if the patient is not under an anæsthetic, it renders the proceeding less painful by protecting the perinæum. The remainder of the vagina is then plugged as tightly as possible with balls of cotton-wool about the size of a golf ball, which have been previously sterilised by boiling and then soaked in lysol solution. This plugging is continued until no more can be pressed into the vagina (*v.* Fig. 296). The patient is then put back to bed, and a binder pinned as tightly as possible round the abdomen, while a T-bandage is brought down between the thighs, and also fixed firmly. By this means, the uterus is compressed between the plug in the vagina and the abdominal binder, and the intra-uterine pressure is raised. The plug is left in until strong labour pains ensue, and this usually happens in from two to four hours. In some cases the onset of labour is slower than this, and in such the plug must be

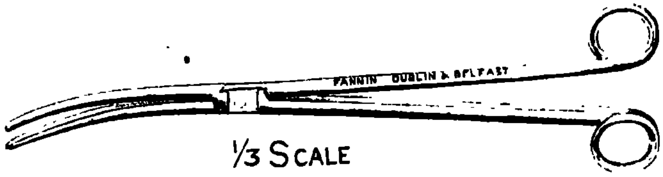

FIG. 405.—FORCEPS FOR PLUGGING THE UTERUS

removed in twenty-four hours for fear of decomposition taking place. If hæmorrhage comes on again, it can be replaced, but this is rarely necessary.

The uterus is plugged with iodoform gauze in the following manner:—Place the patient in the cross-bed position, and seize the anterior lip of the cervix with one American forceps and the posterior lip with another. If a posterior speculum is at hand, it may be introduced, and will facilitate the proceeding. It is not, however, necessary. Then, pass the end of a long strip of iodoform gauze, about two inches in width, up to the fundus, by means of a special plugging forceps or with the end of the Bozemann's catheter. The remainder of the strip is pushed up piece by piece until it is finished. A fresh strip is then knotted on to the former, and introduced in a similar manner. As soon as the uterus is full, the forceps are removed, and the vagina is also plugged. As a rule, three to four strips of gauze, six yards long and two or three inches wide, are required. It must be remembered that it is not the large cavity of a dilated uterus which we have

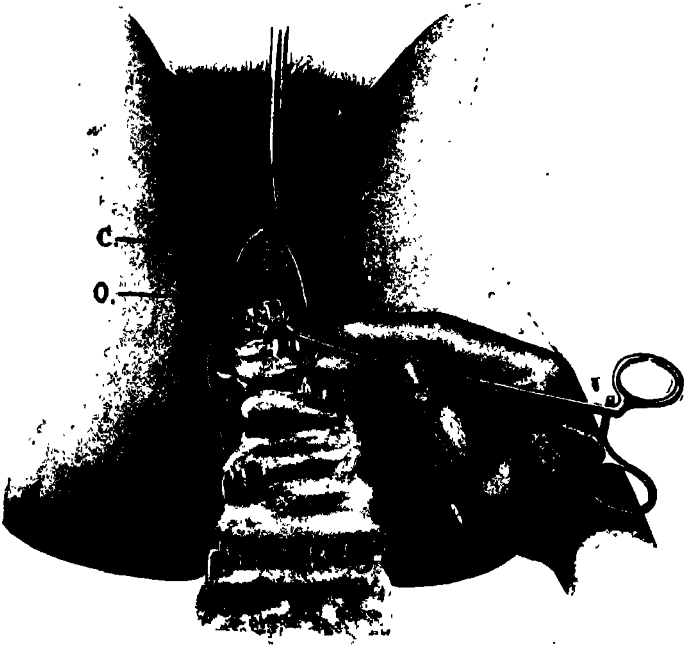

Fig. 406.—Tamponade of the Uterus.

C., Anterior lip of cervix. O., uterine orifice.

to plug, but rather the comparatively small cavity of a contracting one, because on the introduction of a small piece of gauze the hitherto flaccid uterus quickly contracts upon the foreign body. Finally, a tight abdominal binder is applied in order to compress the uterus from above, and ergot may be given. The gauze must be removed in from twelve to twenty-four hours, and if there is any rise of temperature a uterine douche ought to be administered.

CHAPTER II

THE APPLICATION OF THE FORCEPS

The Introduction of the Forceps—The Modern Forceps, Tarnier's, Milne Murray's, Neville's—The Action of the Forceps—Indications—The Mode of Application, the Pelvic Method, the Cephalic Method—The Application of the Forceps in Presentations other than the Vertex; in Occipito-posterior Positions of the Head, in Face Presentation, in Brow Presentation, in Pelvic Presentation—Prognosis.

IN the majority of works on obstetrics it is customary to devote a considerable amount of space to the history of the invention of the forceps, and to a description of many of the hundreds of patterns which have been devised from time to time of this instrument, and also to enter with considerable minutiæ into the discussion of the various moot points which have arisen since its introduction some three hundred years ago. We do not, however, consider that such a discussion is very profitable. Theories with regard to the use of the forceps and its correct design have become crystallised by experience into principles, and these principles, though subject to slight modification, according to locality, are generally recognised by obstetricians. Accordingly, our introduction to the actual description and use of the forceps will be very short.

In, or about, the year 1600, a member of the Chamberlen family—in all probability Peter Chamberlen the elder—devised the prototype of the modern forceps. He and his successors kept the instrument as a family secret for a number of years, until, about the year 1730, Hugh Chamberlen allowed it to be divulged. The instrument used at that time bore a rough resemblance to the short forceps which is still sometimes seen. The first improvement of importance was made when Levret in 1747, and Smellie in 1751, working independently, added a second or pelvic curve, and at the same time increased its length. No further improvement of importance was made until 1877, when Tarnier introduced the principle of axis-traction, which has done so much to improve the value and general utility of the instrument. So far as the British forceps is concerned, obstetricians are indebted to Simpson and Barnes for the two prevailing types of instrument, and to Neville and Milne

Murray for the application to the latter of a suitable axis-traction apparatus.

It is now generally recognised that a suitable forceps must answer to the following description:—It must be made completely of metal; it must be a 'long' forceps, possessing a cephalic and a pelvic curve; and it must possess an axis-traction apparatus, with or without which it can be used. Many different patterns of the forceps fulfil these requirements, but the three which we named above, Neville's, Milne Murray's, and Tarnier's, are in our opinion the best of their respective classes.

The Modern Forceps.—The modern forceps consists of three parts:—a left or lower blade; a right or upper blade; and an axis-traction apparatus. The nature of the blades of the forceps can be best learnt from the accompanying drawings. As will be seen, each blade possesses two curves—a cephalic curve which enables the blade to adapt itself to the head of the fœtus, and a pelvic curve which enables it to lie in the curve of the parturient canal. The blades are made to interlock by means of a readily detachable joint. In the case of Tarnier's forceps the joint is what is known as a French joint, in the case of Barnes' or Simpson's forceps it is what is known as an English joint. The latter is perhaps the better, as it can be more easily and quickly opened. The blades cross one another at this joint in scissors fashion. When the blades are interlocked, one lies below the other, and consequently it is termed the lower blade, and its fellow the upper blade. Similarly, when the forceps is in position inside the pelvis, one blade lies at the left side of the pelvis, and its fellow at the right side. The former consequently is known as the left blade, the latter as the right blade. If the forceps are held in the position they would occupy when gripping the head, it will be seen that the left blade is also the lower blade, while the right blade is the upper blade. Students are often confused between the two blades, and many devices have been suggested for enabling them to easily recognise each. The easiest way is to hold each blade in turn as it would lie with regard to an imaginary patient—the cephalic curve so turned that it can catch the head, and the pelvic curve so turned that it will be adapted to the curve of the pelvis. The side to which the blade belongs will then be obvious, and if the blades are crossed with the right-hand blade uppermost, they will readily lock.

The exact nature of the axis-traction apparatus differs according to the particular type of instrument, but, speaking in general terms, it is an appliance detachable or fixed, which is fastened to the blade either just below the fenestræ or at the lock, and which enables traction to be made on the forceps in a line directly continuous with the axis of the fenestra, *i.e.*, of that portion of the blade which grips the head of the fœtus. At the same time, the traction apparatus is so jointed that the forceps is free to rotate, and to follow the movements of the descending head while traction is being applied. It is these two points—the application of the traction force directly in the line of the axis of the fenestra, and the freedom of the forceps to follow the movements of the head—which constitute the enormous advantage of the axis-traction forceps. When the head of the fœtus is either being driven or being pulled through the pelvis, it has to follow the curve of the pelvis, and the more closely the line of direction of the force which is acting upon it corresponds with the pelvic axis, the less force will be required to bring the head through. If the line of force does not correspond with the pelvic axis, but is partly pushing, or pulling, the head against the anterior, lateral, or posterior wall of the pelvis, a correspondingly greater degree of force is required. When the forceps is correctly applied, the axis of the fenestra of the blades corresponds with sufficient correctness to the axis of that part of the parturient curve in which the head is at the time situated, and, if traction can be applied to the forceps in the axis of the fenestra, the force will be transmitted to the head in the proper manner. It is, however, at once evident that, if we apply traction to the handles of the ordinary forceps without any axis-traction apparatus, we shall be pulling not in the axis of the pelvis, but in a line much anterior to the latter. This is clearly shown in the accompanying diagram (*v.* Fig. 407). The force applied to the handles acts along the line AC, and can be resolved into two forces, one of which, AB, acts in the required direction—*i.e.*, in the pelvic axis, while the other, AE, acts in an entirely different direction, drags the head against the

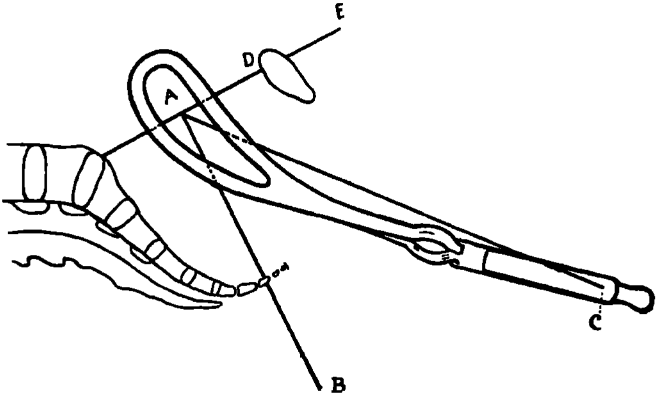

FIG. 407.—TARNIER'S DIAGRAM SHOWING DEFECTS OF ORDINARY FORCEPS.

AC, Line of actual traction; AB, direction of effective co-efficient of force employed; ADE, direction of ineffective co-efficient wasted against the symphysis.

back of the symphysis, and consequently is a retarding rather than an accelerating force.

Various devices have been adopted to prevent this waste of energy. Forceps have been made with a third or perinæal curve with the object of bringing the handles back again into the axis of the blades, and the manœuvre known as Pajot's was introduced, by means of which the tendency to pull the head against the symphysis was counteracted (*v.* Fig. 408). None of these devices is, however, satisfactory. Traction can be applied in the correct direction by means of a perinæal curve on the forceps, but in such a forceps the second great desideratum to which we referred above is wanting, *i.e.*, the freedom of the forceps to follow the movements of the head. In the modern and properly constructed axis-traction forceps, the head guides the forceps, while in any pattern of forceps without an axis-traction apparatus the forceps guides the head. The same objection applies to Pajot's manœuvre, with this added, that it is impossible to apply by means of it the same amount of force in the required direction that can be applied by axis-traction.

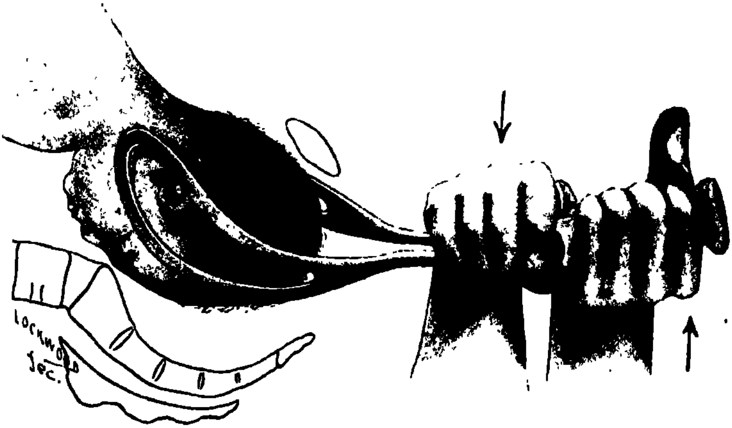

FIG. 408.—PAJOT'S MANŒUVRE. (Williams.)

The nature of the axis-traction apparatus in the three forms of forceps to which we have alluded can be best learnt from the drawings. In Tarnier's and Milne Murray's, there are two traction rods fastened by a pivot joint to the blades just behind the fenestræ, while in Neville's there is a single rod which is fastened rigidly to the forceps at the handle side of the lock, the same fastening serving as the connecting tie between the two blades. In Tarnier's and Milne Murray's forceps, the necessary freedom of movement is obtained by the pivotal attachment of the rods, by the power of free rotation of the traction handle, and by an intermediate joint. In Neville's forceps, it is obtained by a similar power of rotation of the handle, and by two intermediate joints on the rod, one joint permitting lateral, the other vertical movement. In Tarnier's and Milne Murray's forceps the direction in which traction is to be applied is shown by the relation of the traction rods to the handles of the forceps, the rods being kept close to the handles without touching them. In Neville's forceps, there is on the movable part of the traction apparatus an arrow-head indicator, which is to be kept in opposition to the pointed end of the rigid portion of the traction apparatus. In the last pattern of Milne Murray's forceps, the position of the traction handle can be so altered that the line of traction can be made to lie in front of or behind the axis of the upper half of the blades. Under ordinary

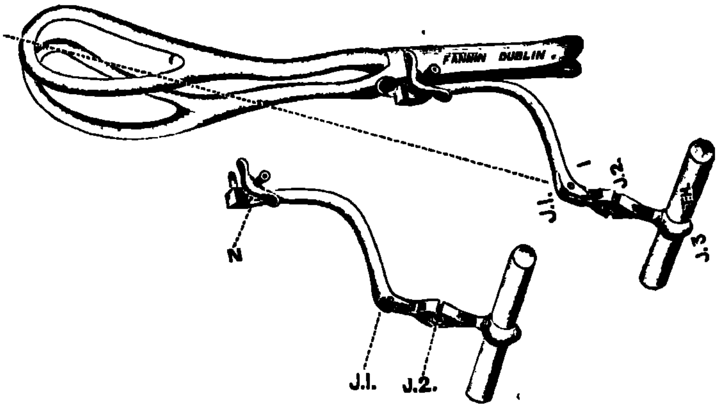

FIG. 409.—NEVILLE'S AXIS-TRACTION FORCEPS.

N, Butterfly-nut for fixing traction rod to the forceps; J.1, J.2, J.3, joints permitting—1, vertical movement; 2, lateral movement; and 3, rotation.

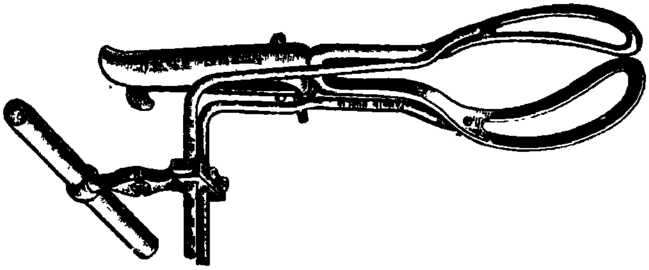

FIG. 410.—MILNE MURRAY'S AXIS-TRACTION FORCEPS.

circumstances, the two should correspond, but Milne Murray considered that in certain forms of pelvic deformity it was advisable to be able to alter their relations.

As regards the relative merits of the different patterns of the forceps, those who are accustomed to any particular pattern consider that pattern the best, and unless they find one which offers a manifest improvement are unwilling to change. We doubt if there is any marked advantage possessed by one of the forms which we have referred to over the others. We ourselves are accustomed to Neville's forceps, and prefer it. It has the advantage over the others that the traction apparatus is more simple, and that it is only fixed to the forceps after the blades have been applied to the head. In the other forms, the traction rods are apt to give trouble, during the application of the blades, to anyone not perfectly familiar with their working. The objection has been brought against Neville's pattern that, because the traction rod is attached to the handles instead of to the blades, it is not a true axis-tractor. We do not profess to be able to offer an opinion on this point, but the question was referred on more than one occasion to a distinguished scientist--the late Professor G. F. Fitzgerald, F.R.S., and he unhesitatingly expressed the opinion that the point of attachment of the rods did not add to or take from the qualities of an instrument as an axis-tractor provided that the traction was applied in the required direction. In Milne Murray's last pattern of forceps, it appears to us that, if the pivotal attachment of the rods to the blades was made rigid, and the horizontal portions of the rods fastened rigidly to the handles, the forceps would still be as truly an axis-traction forceps as they are in their present form, provided the joint at the junction of the traction handle to the vertical part of the rods was sufficiently free, and was fitted with a suitable indicator to take the place of the indicator now afforded by the relation of the horizontal portion of the traction rods to the handles.

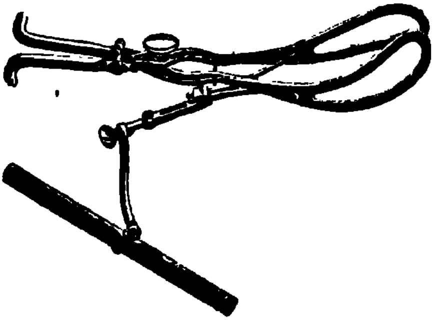

FIG. 411.—TARNIER'S AXIS-TRACTION FORCEPS.

The Action of the Forceps.—The forceps can be used for several distinct purposes. It can be used as a tractor, rotator, compressor, or dilator. Its chief and most important use is as a simple tractor, that is, as a means of applying the necessary traction to the head to draw it downwards through the pelvis. Occasionally, it is permissible to use it as a rotator, with the object of bringing about the necessary internal rotation of the head. This use is seldom required save in cases of occipito-posterior position of the head, as we shall subsequently see. The use of the forceps as a compressor, *i.e.*, as a means of lessening certain diameters, is not one to be recommended. The forceps most usually lies in relation to a transverse or oblique diameter of the pelvis, and it is but rarely that these diameters offer an obstruction to the passage of the head, unless there is at the same time a greater degree of obstruction in the antero-posterior diameters, in which case the compression of the diameters of the head which lie in the transverse or oblique diameters of the pelvis is of little advantage. Further, if the fœtus is alive, compression is dangerous, while if the fœtus is dead and compression of the head is necessary in order that it may be delivered, there are other and better methods of effecting delivery. The use of the forceps as a dilator of the uterine orifice is also inadvisable. If possible, the forceps should never be applied unless the uterine orifice is sufficiently dilated to allow the passage of the head, and, in the rare cases in which it is necessary to do so, preliminary dilatation should be effected or the cervix incised.

Indications.—The indications for the use of the forceps can be divided into two groups:—Indications on behalf of the child; and, indications on behalf of the mother.

In the first group are the following indications:—

(1) A fœtal heart-rate rising progressively above 160 in the interval between the pains, or falling below 120.
(2) Tumultuous movements on the part of the fœtus.
(3) The coming away of meconium, unmixed with liquor amnii, in a head presentation.
(4) Prolapse of the cord.

In the second group are the following indications:—

(1) Accidental hæmorrhage and placenta prævia.
(2) Threatened rupture of the uterus.
(3) Unduly prolonged second stage, as shown by the exhausted condition of the patient.
(4) Convulsions.
(5) Cardiac, pulmonary, renal, or other form of grave organic disease.
(6) Hæmatoma of the vulva.

The foregoing indications must not all be regarded as equally absolute. Provided the conditions necessary for the safe application of the forceps are fulfilled, they are all absolute, because under these circumstances the forceps furnishes the best means of delivering the fœtus with a minimum of risk to it and to the mother. If, however, these conditions are not fulfilled, then it is necessary to decide whether the danger incurred by waiting is so great as to necessitate the immediate delivery of the fœtus, and, if it is so great, whether the forceps offers the best means of effecting delivery under the circumstances.

For the safe and easy application of the forceps, the following conditions must be fulfilled:—

(1) The uterine orifice must be sufficiently dilated to allow the passage of the fœtus. If it is not so dilated we are using the forceps not alone as a tractor, but as a dilator, and, as we have said, it is preferable to first effect dilatation of the cervix, and then to apply the forceps, rather than to drag the fœtal head through an imperfectly dilated orifice and to run the risk of causing deep lacerations of the cervix. If, as sometimes happens, the forceps must be applied through an imperfectly dilated orifice, traction must be made with extreme slowness and gentleness, in order to avoid laceration.

(2) The fœtus must present by the vertex, or posterior fontanelle, or, if the face presents, the chin must have rotated forwards. In other presentations of the head, it is doubtful whether the forceps offers a better prospect of effecting delivery than do the unaided uterine contractions, and probably it is only when the latter are feeble that the forceps will prove of service.

(3) The greatest diameter of the head must have entered the pelvic brim. Even in a normal pelvis and with an axis-traction forceps, there is always a difficulty in pulling a head which is free above the brim into and through the latter. It must be remembered that an axis-traction forceps only enables one to pull in the direction of the axis of the upper half of the blades of the forceps. If this portion of the blades lies in the axis of the pelvic inlet, then our traction will correspond with that axis, but if the blades do not so lie, then our traction will not be made in the axis of the inlet. If the head is fixed in the brim, the pelvic curve of the forceps, and the manner in which the latter adapts itself to the head, ensure that, for all practical purposes, the axis of the blades lies in the required position, but when the head is free to move about above the brim there is no certainty that it will so lie. Rather, there is the extreme probability that we are wasting a certain amount of energy in pulling the head against the symphysis. Further, if the head is lying at the brim in an asynclitic position, the forceps tends to drag it downwards in this position, and prevents it from gradually correcting itself, as it would do if acted on by the uterine contractions alone. Lastly, if the head is free above the brim at a time when there is an indication for immediate delivery, it is probable that there is a disproportion between the head and the brim; and this disproportion is bound to be increased by the lateral expansion of the head that results when the blades of the forceps drag the base

of the skull downwards, and the rigid pelvic ring presses the calvarium upwards.

Several writers are opposed to the belief that compression of the head by the forceps in one horizontal diameter causes a corresponding increase in the length of the other horizontal diameters. Milne Murray, in particular, made a series of interesting experiments on dead infants, which went to show that compression of the head with a cephalotribe in one horizontal diameter did not cause a compensatory increase in the length of the other horizontal diameters of the head, but only caused an increase in the vertical diameters. We confess we find some difficulty in accepting this as correct, but, assuming it to be so in the case of horizontal compression, it does not disprove the occurrence of compensatory lateral increase in the case with which we are now concerned. When the head is dragged downwards on to a narrow pelvic brim, it is compressed, not so much laterally, as vertically, the base being dragged downwards by the forceps, the calvarium being pressed upwards by the pelvis. Such a compression is bound to cause lateral expansion of the head, as the lateral diameters are the only ones which are free to expand. A similar compression also occurs when the head is acted upon by the uterine contractions alone, but here the natural mechanism which the head follows minimises the effect of this compression, and sufficient time is afforded for the head to alter its shape to suit the conditions present. For these reasons, we consider that, instead of contracted pelvis being an indication for the application of the forceps, it is a contra-indication, and that the use of the forceps is only permissible as a last resource, which failing us, we are prepared to perform perforation.

(4) Uterine contractions must be occurring with sufficient regularity and force to ensure the subsequent detachment and expulsion of the placenta, and the closure of the uterine sinuses. The danger of the occurrence of post-partum hæmorrhage in the presence of uterine inertia is considerable, although in some cases delivery by the forceps appears to act beneficially on the contractions and to serve to stimulate them. Uterine inertia is frequently given as an indication for the application of the forceps, but we consider it more correct to regard it as a contra-indication to their use. The presence of uterine inertia may necessitate the use of the forceps, it never indicates its use.

THE APPLICATION OF THE FORCEPS IN VERTEX PRESENTATION.

During the application of the forceps, the patient may be placed in the left lateral position or on the back. In this country, it is usual to adopt the former position. It requires less assistance, as a single nurse can easily manage the patient when on the side, while, if she is placed in the dorsal cross-bed position, two assistants are usually required—one to hold each leg. It offers the further advantage that it is more easy to follow the advance of the head and to take effective measures for the protection of the perinæum. On the other hand, if the case requires the exertion of a considerable amount of traction force, it is easier to apply the latter with the patient on the back. If the side position is chosen, the patient is placed as shown in Fig 412,

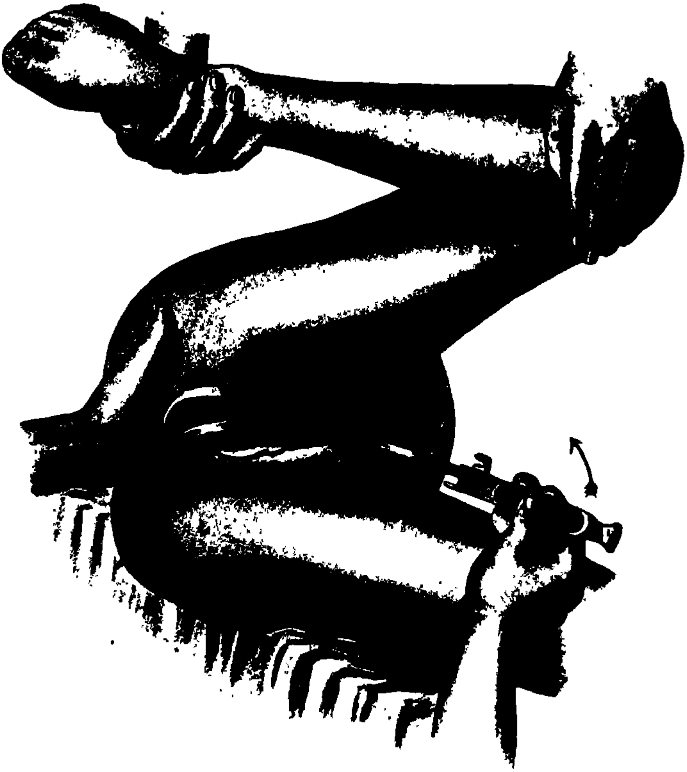

FIG. 412—THE INTRODUCTION OF THE LOWER BLADE OF THE FORCEPS.

the buttocks projecting slightly beyond the side of the bed, and the thighs and legs flexed. During the introduction of the blades, the nurse holds the right leg as shown, but, as soon as traction is commenced, she should sit on the bed behind the patient's back, and, bringing the left hand round the thigh from inside and the right hand round from outside, clasp them firmly so as to encircle the thigh just above the fold of the nates. In this position, she can provide the necessary counterstrain to the traction force exerted by the operator, and so prevent the patient from slipping too far off the bed.

As soon as the patient has been thoroughly washed, disinfected, and anæsthetised, the bladder is emptied with a catheter, and the membranes ruptured. A careful vaginal examination is then made to determine the exact presentation and position of the head and its relation to the pelvis, the condition of the cervix, and the presence of any abnormality of the pelvic walls or the soft parts.

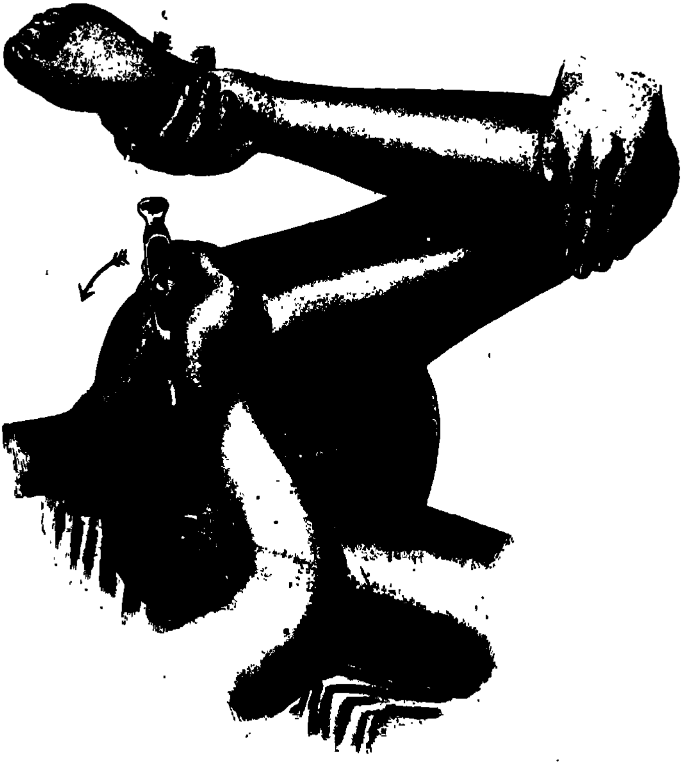

FIG. 413.—ROTATION OF THE HANDLE OF THE LOWER BLADE OF THE FORCEPS TO BRING THE BLADE TO THE LEFT SIDE OF THE PELVIS.

There are two methods of applying the forceps, both of which have their advocates. The first consists in applying it in relation to the pelvis, so that one blade lies at one side of the pelvis, the other blade at the opposite side, without taking into consideration the position of the head. The other, the cephalic method, in which the forceps is applied in a fixed relation to the head whatever may be the position of the latter, is undoubtedly the more correct, and is the method which will allow the head to be extracted with the least force.

The pelvic method of applying the forceps is the easier, and is probably the one almost universally adopted in these countries. It means that the forceps always lies in relation to either the transverse or the oblique diameter of the pelvis, and that consequently the pelvic curve of the forceps always corresponds more or less exactly with the curve of the pelvis. On the other hand, owing to the irregular manner in which the head is seized, difficulty may be experienced in locking the forceps, and the head may be injured by compression.

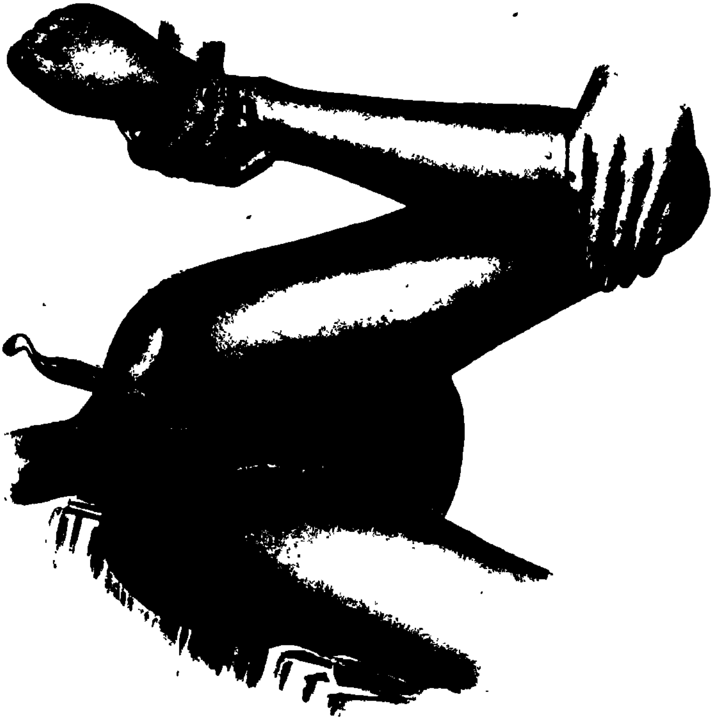

FIG. 414.—THE LOWER BLADE OF THE FORCEPS *IN SITU*.

In the cephalic method, the forceps is applied in a vertex presentation so that the blades lie along each side of the head, the long axis of the fenestræ corresponding as exactly as possible with the supra-occipito-mental or the occipito-mental diameter of the head (*v.* Fig. 420). This method was recommended by Smellie and Baudelocque, and though for a time given up, was re-introduced by the modern French obstetricians. At the present time, it is strongly advocated by Pinard, Ribemont-Dessaignes, and Whitridge Williams. The first-named stated that whatever was the height or position of the head, it should be gripped in a regular manner, as we have just described. Williams and Farabœuf, however, rightly point out that when the head is free above the brim it is not possible to grip it transversely, since the head when in this position usually lies with its antero-posterior diameters corresponding to the transverse diameters of the pelvis, and, consequently, the forceps, if applied to the sides of the head, will also lie in the conjugate diameter of the pelvis. Such a position is objectionable for several reasons. In the first place, the blades take up a certain amount of room, and so make still more narrow the presumably already narrowed conjugate. Then, the pelvic curve of the forceps no longer corresponds with the curve of the pelvis, and, consequently, it is impossible to exert traction with them in the required direction, and, even if the head is brought down into the brim, the posterior blade bridges across the sacral concavity and prevents the head from descending. In all cases, however, in which the head is in the pelvic cavity or at the outlet,

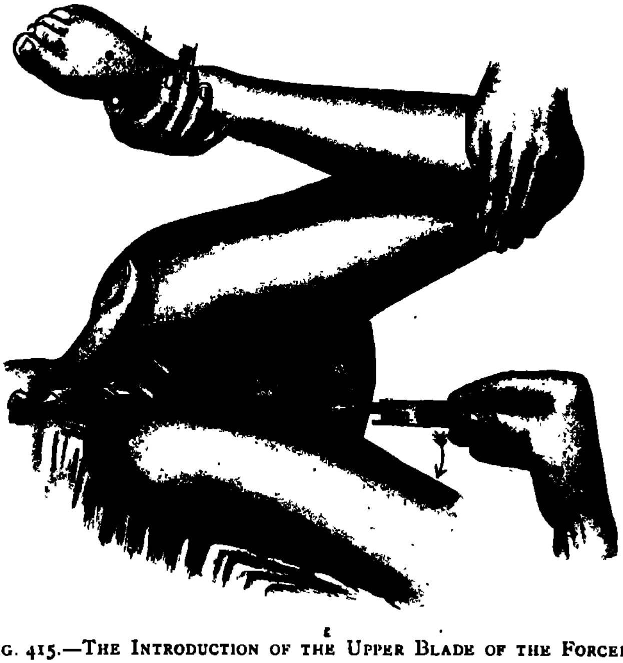

FIG. 415.—THE INTRODUCTION OF THE UPPER BLADE OF THE FORCEPS.

Williams and Farabœuf agree that the cephalic application of the forceps is the proper one, and that, even if the head lies with its antero-posterior diameters in relation to the transverse diameters of the pelvis and the forceps has to be applied in the conjugate, cephalic application is still the better method. The advantages of this method of application are three:—First, that a firm grip of the child's head is obtained; secondly, that the head is seized in the least injurious manner; and, thirdly, that

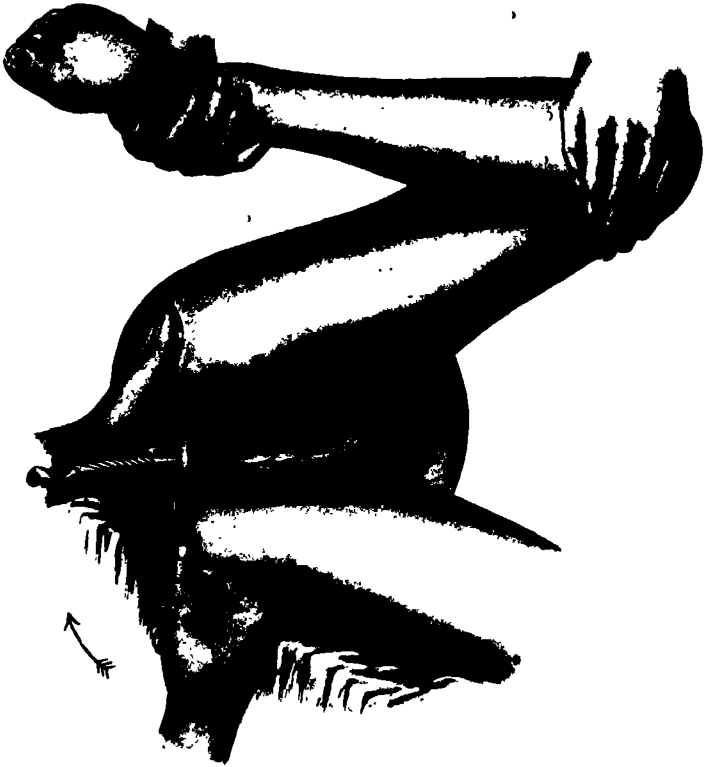

FIG. 416.—ROTATION OF THE HANDLE OF THE UPPER BLADE TO BRING THE BLADE TO THE RIGHT SIDE OF THE PELVIS

the head is pulled down in the natural position of flexion, and that a minimum amount of force is required.

With regard to a choice between the two methods of applying the forceps, we are not going to say much. Every obstetrician has been brought up to practise one or the other, and he will probably adhere to that with which he is most familiar. It is important to remember that in the majority of cases there is no essential difference between the two methods, inasmuch as the head most frequently lies with the occiput to the left and in front, and in such cases, whether the mode of application chosen is the pelvic or the cephalic, the forceps will grip the head transversely, and in relation to the mento-occipital diameter. Consequently, it is only in atypical positions of the head that the one method differs from the other. These are, however, just the cases in which difficulties often arise and in which every manœuvre that facilitates delivery is of assistance. For this reason, we advise

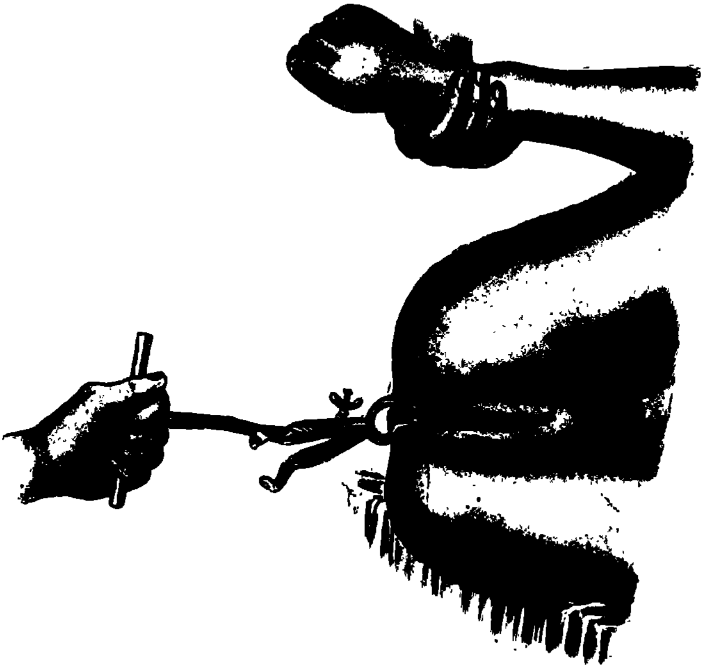

FIG. 417.—THE BLADES LOCKED, AND THE AXIS-TRACTION APPARATUS APPLIED.

The head is engaged in the brim; note the direction in which traction is made.

the student to learn both methods, and, in all cases, so far as possible, to endeavour to apply the forceps in whatever manner enables the head to be delivered with the least amount of force.

We must now describe in detail the steps in the application of the forceps in each method, and will commence with the pelvic method, as it is the more common.

The Pelvic Method.—When the patient lies in the left lateral position, the left or lower blade of the forceps is taken in the

CHAPTER III

VERSION, AND EXTRACTION IN PELVIC PRESENTATION

Version—Varieties—Indications—Contra-indications—Methods of Performing Version—External Version—Combined or Bi-polar Version Internal Version—The Extraction of the Fœtus in Pelvic Presentation The Extraction of the Pelvic Pole—The Liberation and Delivery of the Arms—The Delivery of the After-coming Head, The Prague Method, Martin's Method, Sme'lie's Method, The Application of the Forceps.

VERSION

Version or turning is the term applied to the operation by which one polar presentation is substituted for another, or a longitudinal lie is substituted for a transverse lie. Thus, a shoulder presentation or a pelvic presentation may be changed by version into a cephalic presentation, or a shoulder presentation or a cephalic presentation into a podalic presentation.

There are two varieties of version, each named after the resultant presentation. These are:—

I. Cephalic version, by which a pelvic presentation or transverse lie is changed into a cephalic presentation.

II. Podalic version, by which a cephalic presentation or transverse lie is changed into a pelvic presentation.

Indications.—Version is possible in all cases in which the presenting part is not so deeply engaged in the pelvis that it is impossible to push it above the pelvic brim. It is indicated in two classes of cases:—

(1) In all cases of transverse lie of the fœtus.

(2) In certain cases of longitudinal lie, in which the presentation of the opposite pole of the fœtus is likely to improve the prognosis for either the mother or the fœtus.

As a head presentation offers the best prospect to the fœtus, cephalic version is the variety of version always to be chosen in the first class of case, and it is only if the head cannot be induced to engage in the brim, if it engages in a faulty attitude, or if the immediate delivery of the fœtus is required in consequence of some complication, as a prolapsed cord, that podalic version is performed instead.

In the second class of case, cephalic version is indicated in pelvic presentation under certain circumstances, and to these we have already referred.* Podalic version, on the other hand, is indicated in all cases of brow or face presentation which cannot be changed into a vertex presentation, and in posterior fontanelle presentation, provided that the pelvis is sufficiently large to allow the passage of the fœtus. It is also indicated in certain cases of prolapse of the cord, of placenta prævia, and of flattened pelvis.

Contra-indications.—The performance of version is contra-indicated under the following conditions:—

(1) If it is obvious that, even after version, the fœtus cannot be delivered without mutilation, owing to its size or to the presence of pelvic contraction.

(2) If the membranes have been ruptured for a considerable time, and the retraction ring is more than two and a half inches above the symphysis pubis, in consequence of the danger of rupturing the uterus during the necessary manipulations.

(3) If the fœtus is in great part expelled from the uterine cavity, and the uterus is tightly contracted down on the remainder. The performance of version necessitates the replacement in the uterine cavity of the already expelled portion of the fœtus, and this cannot be done without the gravest risk of uterine rupture.

There are three methods by which version can be performed, namely:—

I. External Version, *i.e.*, the turning of the fœtus by external manipulations, performed with the hands on the abdominal wall.

II. Bi-polar or Combined Version, *i.e.*, the turning of the fœtus by associated external and internal manipulations, the former performed with one hand on the abdominal wall, the latter with the fingers in the uterus.

III. Internal Version, *i.e.*, the turning of the fœtus by internal manipulations, performed with the whole hand in the uterus.

In choosing the method to be adopted in any particular case, we are guided by the general principle that version should be performed with the least amount of intra-uterine manipulation possible. Consequently, external version is in all cases the method of choice; if it cannot be performed bi-polar version is chosen; and, if this too is impossible, internal version is performed.

EXTERNAL VERSION.

External version is the term applied to the turning of the fœtus by manipulations practised through the abdominal wall. It was first introduced by Wigand† in 1807, and though for many years it did not meet with the recognition it deserved, and even still is not the method selected in many cases in which it is practicable,

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[*] *Vide* Part IV., Chap. VI., p. 417.

[†] 'Ueber Wendung durch äussere Handgriffe,' *Hamburger Med. Mag.*, 1807, vol. i., p. 52.

The left lower blade is still introduced first, but it is held in the left hand, while the right hand serves as the vaginal guide. The right blade, on the other hand, is held in the right hand, while the left hand serves as the vaginal guide. If the head is high in the pelvis, the operator must sit upon a low seat, as otherwise he will not be able to get his hands sufficiently low to pull in the correct direction.

The Cephalic Method. — The principal points of difference between the cephalic and the pelvic methods of applying the forceps are as follows:—As soon as the patient has been thoroughly washed and disinfected, introduce as much of the hand as is necessary and determine the position of the posterior ear. Then, apply over that ear the corresponding blade of the forceps. If the ear is directed to the left side of the pelvis, apply the left blade; if to the right side, apply the right blade. If the head lies transversely, apply the left blade if the occiput points to the left, and the right blade if the occiput points to the right. If the head lies antero-posteriorly, and, consequently, neither ear is posterior to its fellow, apply the left blade first over the ear which is directed towards the left side. As soon as the first blade is in position, apply the second blade over the opposite ear. The blades are guided into position by means of a hand in the vagina passed upwards beside the head, as has been described. If the patient is lying on the left side, the left hand is introduced in all cases into the vagina. If the patient is lying on the back,

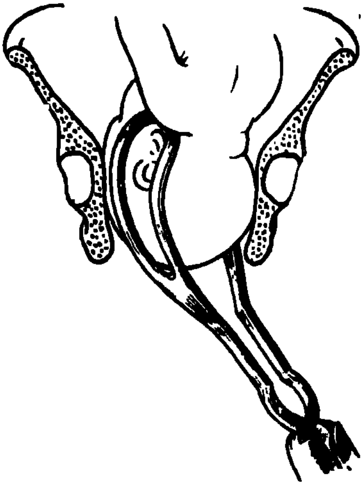

FIG. 420.—THE RELATION OF THE FORCEPS TO THE HEAD IN A FIRST VERTEX PRESENTATION WITH THE BACK IN FRONT.

the right hand is introduced when the left blade is being applied, the left hand when the right blade is being applied. In all cases, we endeavour to make the forceps lie with the blades over the ears, and with its long axis corresponding to the occipito-mental or sub-occipito-bregmatic diameter of the head (*v.* Figs. 420, 421). In cases in which the right blade is applied first, a slight difficulty will arise in that, when the left blade is introduced, it will lie above the right, and the locks will not fall together. This difficulty can be overcome by rotating the left handle round the right handle, and so bringing them into their correct relation.

It will be noticed that, if the instructions given above are followed, when the head lies with its antero-posterior diameters corresponding to the transverse diameter of the pelvis, the forceps will lie in the antero-posterior diameter of the pelvis. This position, although it discounts the existence of the pelvic curve of the forceps, is, as we have already said, sanctioned by French writers in all cases in which the head lies in the pelvic cavity or near the outlet. Pinard advises its use in cases in which the head is above the brim, but he appears to be the only writer to do so, and, indeed, the practice appears open to too many objections to need consideration.

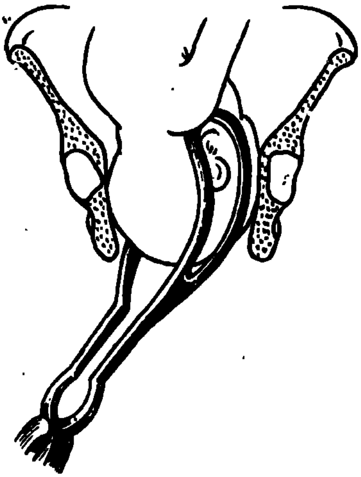

FIG. 421.—THE RELATION OF THE FORCEPS TO THE HEAD IN A SECOND VERTEX PRESENTATION WITH THE BACK IN FRONT.

The forceps having been applied by whichever method is thought best, the next point is to extract the fœtus. As soon as the blades have been locked, the axis-traction apparatus is applied, the butterfly-nut that holds the blades together is screwed up just sufficiently tightly to prevent the blades from falling apart, and traction is made as shown in Fig. 417. At first, traction should be made with one hand, and it is only in the event of this proving insufficient that both hands are used. Traction is made intermittently, and, if uterine contractions are occurring, should be made concurrently with them. The direction in which to pull is shown by the indicator on the axis-traction apparatus. If the head is entering the brim, we first pull downwards and backwards in the axis of the inlet (*v.* Figs. 417-419). Then, as the head passes into the pelvic cavity, we pull almost directly downwards, then directly downwards, then, as the head approaches the outlet, downwards and forwards, and, lastly, as the head emerges, almost directly forwards. As the head is passing over the perinæum, the forceps may be removed, or be allowed to remain. Many writers recommend its removal, but Milne Murray considered that a great part of the value of axis-traction was lost by doing so. Personally, we do not consider that it is a matter of much importance which course is adopted. The advantage of removing the forceps is that the head, when born, is free, and the forceps is out of the way.

THE APPLICATION OF THE FORCEPS IN PRESENTATIONS OTHER THAN THE VERTEX.

So far, our remarks have been intended to apply to the use of the forceps in vertex presentation only, but there are also other presentations in which the forceps may have to be used, and with these we must now deal. We may preface what we have to say by repeating that, for the safe and easy application of the forceps, the vertex must present. In all other presentations the application of the forceps is difficult, and attended with risk; consequently, it is only in the presence of an urgent indication for delivery that the forceps ought to be applied in such cases.

In Occipito-posterior Position of the Head.—It not infrequently happens that, in consequence of delay during the second stage of labour due to failure of an occipito-posterior position of the head to rotate, the forceps has to be applied. In such cases, during extraction of the head, internal rotation may so occur as to bring the occiput either directly posterior or forwards beneath the arch of the pubes. In the former case, delivery is more difficult, and deep lacerations of the perinæum and vagina may occur. In the latter case, the forceps will rotate with the head, and turn so that its pelvic curve is looking backwards instead of forwards, thus necessitating its removal and re-application. This, however, is easy to do, and, accordingly, if possible, the head must be made to rotate in such a direction as to bring the occiput anteriorly. In all cases, the forceps is applied so far as possible to the sides of the head, the pelvic curve directed towards the face, *i.e.*, anteriorly. If the head is not already on the pelvic floor, traction is made, and it is pulled down on to the latter. Then, if traction is continued, the head will in some cases rotate of itself under the influence of the pelvic floor, and bring the occiput anteriorly. If it does not do so, Whitridge Williams recommends* gentle rotation of the forceps during traction in such a manner as to bring the occiput forwards. If such a rotation occurs, the forceps must be removed and re-introduced in a proper position, as has been already described. If the head cannot be made to rotate forwards, the exertion of a considerable amount of force will probably be required in order to effect delivery. As the occiput is emerging, the handles of the forceps must be carried well forward towards the abdomen of the mother, and then, as soon as the occiput is born, carried backwards in order to bring the face from behind the symphysis.

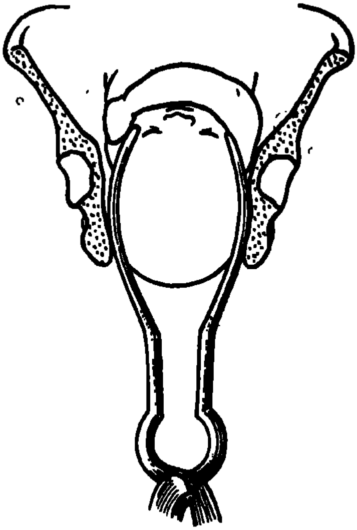

FIG. 422.—THE RELATION OF THE FORCEPS TO THE HEAD IN AN UNCORRECTED OCCIPITO-POSTERIOR POSITION OF THE VERTEX.

In Face Presentation.—The forceps may be occasionally required in face presentation, but as a rule it is better if possible to avoid its use. If it is used, it is essential in the interests of the fœtus that the cephalic method of application is adopted, as the forceps, irregularly applied to the head in a face presentation, may directly bring about the death of the fœtus by causing pressure on the vessels and nerves of the neck. The forceps can be applied provided the face lies either transversely it constituted a great advance in obstetrics by enabling external to be substituted for internal manipulations.

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* *Op. cit.*, p. 372.

Indications.—External version is the method of choice in all cases in which it is necessary to alter the presentation of the fœtus, and its adoption is only limited by necessity, since in some cases, it is impossible to perform it. For its performance, the following conditions must be fulfilled:—

(1) The fœtus must be freely movable in the uterus.

(2) The abdominal walls must be relaxed.

(3) It must be possible to palpate the fœtus and distinguish its different poles.

Operation.—The operation of external version is not a painful one, and, consequently, an anæsthetic is not necessary on this account. In many cases, however, an anæsthetic may be necessary, in order to obtain complete relaxation of the abdominal muscles, as, if they are contracted and rigid, it is impossible either to ascertain the position of the fœtus correctly, or, having ascertained the position, to alter it. As soon as relaxation of the walls has been obtained, the obstetrician sits on the couch beside the patient in the position adopted when performing abdominal palpation, and ascertains the exact position of the fœtus. He then places one hand over the pelvic pole, the other over the cephalic pole. If he desires to perform cephalic version, he gently pushes the cephalic pole with the corresponding hand in whatever direction brings it over the pelvic brim by the shortest route. If the head is at the fundus, and each route is equally direct, it is probably better to push the cephalic pole in the direction of the fœtal back, the pelvic pole in the opposite direction, as in this way flexion of the head is maintained. The choice of the route in such cases is not, however, of much practical importance. If we desire to perform podalic version, the opposite procedure is adopted, and the pelvic pole of the fœtus is brought over the pelvic brim. As soon as the required pole has been brought over the brim, the final step consists in ensuring that it remains there and becomes fixed in the brim, as it is often inclined to slip away and the original presentation to recur. For this reason, there is very little use in performing external version until labour has commenced. Then, having turned the fœtus, a head presentation can be kept in position either by holding it over the brim until the uterine contractions fix it, or by applying a firm abdominal binder supplemented by two longitudinal compresses, one at each side of the fœtus, to prevent the latter from slipping round. If these measures do not succeed, the membranes must be ruptured, in order to enable the uterus to contract down on the body of the fœtus and so maintain the position of the latter. After podalic version, it is usually customary to draw down a foot into the vagina, but as this cannot be done by external manipulation, it must be considered as a part of combined or internal version rather than of external version.

BI-POLAR OR COMBINED VERSION.

Bi-polar, or combined external and internal version is the term applied to the turning of the fœtus by associated external and internal manipulations, the former performed with one hand on the abdominal wall as in external version, the latter with two fingers of the other hand in the uterus. According to Winckel, it was first recommended by Hohl* in 1845, but it has come to be invariably associated with the name of Braxton Hicks,† to whom the perfecting and popularising of the operation are undoubtedly due.

Indications.—Bi-polar version is indicated in all cases in which external version is impossible, or insufficient in consequence of the necessity for drawing down a foot into the vagina. To perform it, the same conditions must be fulfilled as for external version, with the addition that the cervix must be sufficiently dilated to admit at least two fingers.

Operation.—In almost every case an anæsthetic is necessary, as the introduction of the hand into the vagina causes pain, and leads to straining on the part of the patient. Such straining prevents the proper use of the abdominal hand, and, in cases in which the membranes are ruptured during the operation, may cause the forcing down of the cord past the presenting part. The classical operation of combined version, as described by Braxton Hicks, is as follows:—The patient is placed in the dorsal cross-bed position, and the hand corresponding to the side at which the limbs of the fœtus lie is introduced as far as is necessary into the vagina, while the other hand is placed externally over the breech of the fœtus. The external hand then presses gently but firmly on the breech so as to push it downwards and towards the side at which the feet are situated. As it recedes, the hand follows it, while, at the same time, the fingers of the vaginal hand introduced through the cervix push the head upwards and towards the opposite side. When the breech has been pushed down to about the level of the umbilicus, the head will have cleared the brim, and the shoulder will be opposite the uterine orifice. The shoulder is then pushed upwards in the same manner as was the head, and, after a little further depression of the breech from without, the knee will be found within reach of the vaginal finger and can be hooked down until the foot in turn comes within reach. The operation is completed by drawing the foot through the os, and pushing the head into the fundus with the external hand.

If we desire to perform cephalic version in the case of a breech or a shoulder presentation, the procedure is almost identical with that just described, save that the breech or shoulder, as the case may be, is pushed upwards with the vaginal fingers while the head is pushed downwards from without.

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* Vorträge, 1845, S. 189; and II. Aufl., 1862, S. 789.

† 'On Combined External and Internal Version,' *Trans. Obst. Soc. Lond.*, vol. v., 1863, pp. 219-259, and Appendix, pp. 265, 266.

It has been customary to perform bi-polar podalic version at the Rotunda Hospital for some years in a slightly different manner, and as the Rotunda method offers certain advantages, particularly in cases of placenta prævia, we shall describe it. The patient is placed in the dorsal cross-bed position, and an anæsthetic is administered. The exact position of the fœtus is then ascertained by abdominal palpation, and the fœtus is turned by external version until it lies transversely, its back towards the fundus, and its limbs in the lower part of the uterus. The hand corresponding to the side towards which the breech is turned is then introduced into the vagina, *i.e.*, the left hand if the breech lies on the mother's right, and *vice versâ*, and the opposite hand is placed on the abdominal wall over the breech of the fœtus. Two fingers of the vaginal hand are introduced into the uterus, and the foot is felt for, seized, and drawn down into the

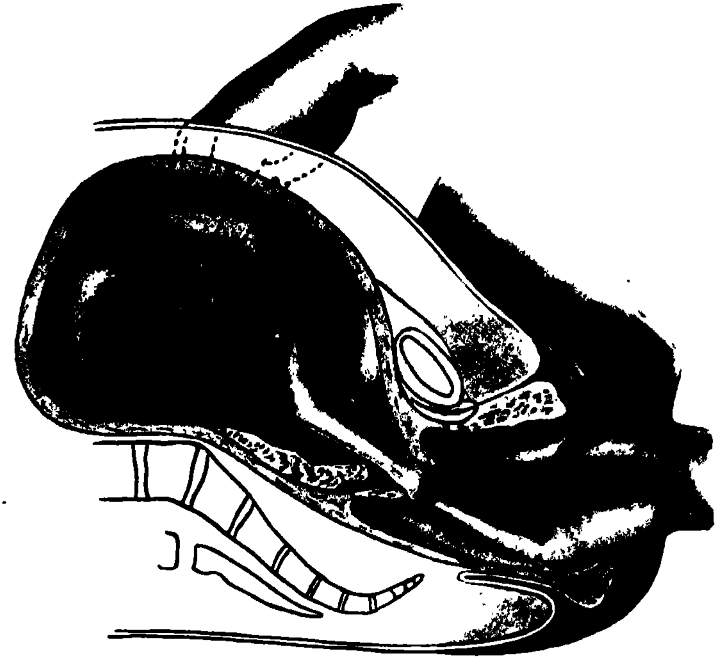

FIG. 424.—COMBINED VERSION.

The method of bringing the foot through a small os by pushing the cervix upwards over the foot with the fingers in the vagina

vagina. If the foot is not within reach, it is brought nearer the internal os by pressure with the external hand over the breech. It sometimes happens that the uterine orifice may be of sufficient size to admit the foot alone or the fingers alone, but will not accommodate all three. In such cases, we have found the following manipulation of use:—Having passed the fingers into the uterus, and caught the foot, draw the latter down as far as possible, and in such a position that the toes point towards the uterine orifice. Then, draw the fingers out of the uterus, place them round the cervix as shown in Fig. 424, and with them push the cervix upwards over the foot, while at the same time the external hand makes the foot descend by pressure upon the breech. In this way, the toes can often be brought through the uterine orifice, and can then be caught by the vaginal fingers and the remainder of the foot brought down. Lastly, the head is pushed up to the fundus with the external hand.

INTERNAL VERSION.

Internal version is the term usually applied to the turning of the fœtus by internal manipulation performed by the whole hand introduced into the uterus. The term 'internal version' is to some extent a misnomer, inasmuch as in no case is the internal hand alone used. In reality, internal version, so called, is a combined external and internal version, and differs from the method that has been just described in that the whole hand is introduced into the uterus instead of two fingers, the use of the external hand being identical in both methods. For this reason, the terms applied to the two methods by Winckel are preferable to those in common use, *i.e.*, for bi-polar version—'combined indirect version,' and for internal version—'combined direct version.' As, however, the term internal version has come to be generally recognised and its meaning understood, we prefer to make use of it.

Indications.—Internal version is indicated in all cases in which external or bi-polar version is impossible. For its performance, one condition is necessary in addition to the general conditions already given, namely, that the uterine orifice is sufficiently dilated to admit the entire hand. Theoretically both cephalic and podalic version can be performed by internal version, and both D'Outrepont* and Busch have described methods of performing cephalic version in this way, but, at the present time, it is generally recognised that if labour has reached such a stage that it is possible to introduce the entire hand into the uterus, it is preferable to perform podalic rather than cephalic version, as the former is more easy of performance, and can, if necessary, be at once followed by extraction.

Operation.—For the performance of internal version the patient may be placed on her left side in the usual obstetrical position, or on her back in the cross-bed position. We consider that the latter position is the better of the two, as it enables more use to be made of the abdominal hand, and so we shall describe how the operation is performed when the patient is in that position.

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* 'Abh. und Beiträge,' Würzburg, 1817, Theil I., p. 69

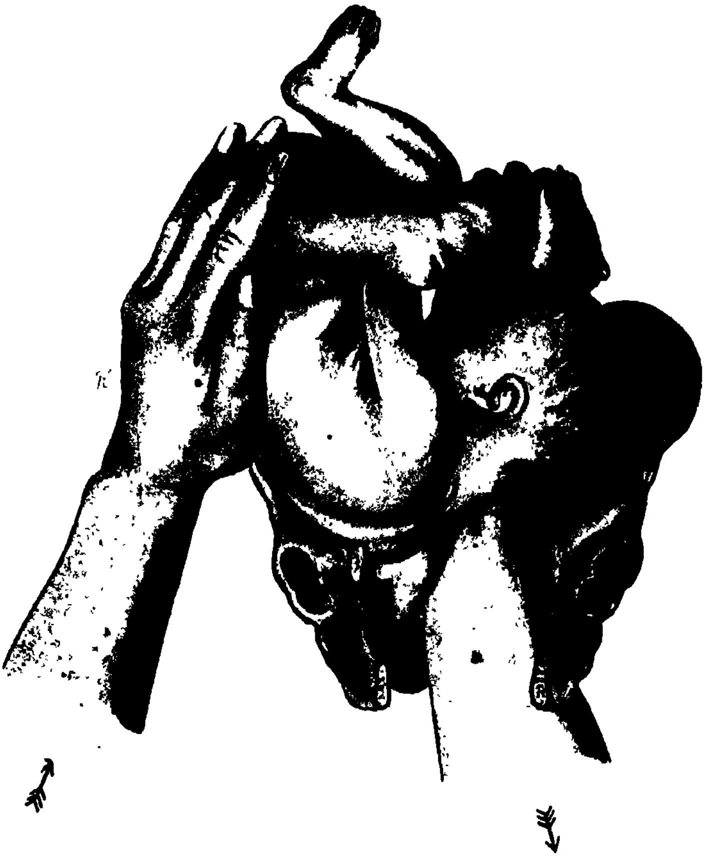

FIG. 425.—INTERNAL VERSION. SEIZING A FOOT.

The first step in the operation, as in all methods of performing version, consists in ascertaining as carefully as possible, by abdominal palpation and vaginal examination, the exact presentation and position of the fœtus. The second step consists in introducing a hand into the uterus, seizing a foot, and drawing it downwards. The final step consists in pushing the head into the fundus of the uterus, and at the same time drawing down the foot more deeply into the vagina. The first step calls for no comment save that the choice of the hand to be introduced into the uterus depends on whether the head or the shoulder presents.

The correct method of carrying out the second step has given rise to endless discussion, and may be regarded as one of the hereditary moot points of obstetrics. In some works, pages are devoted to a discussion on the hand which should be introduced into the uterus, and the foot which should be pulled upon. Inasmuch as it appears that the most distinguished obstetricians hold diametrically opposite opinions on these points, and as each contends that the method he recommends offers advantages over all others, it would appear that there cannot be a very great difference between the methods. This view is supported by our clinical experience, which has taught us that the best hand to introduce is the one which naturally adapts itself to the position in which the feet of the fœtus are placed, and that the best foot to draw down is the foot most easily reached. Thus, in a transverse presentation, we, personally, use the right hand when the lower limbs lie on the right side of the mother, and the left hand when they lie on the left side. In a head presentation we use the right hand in all positions of the fœtus save when the limbs are to the right and in front. In such a case, the left hand is more suitable. A left-handed operator will reverse this procedure, and in a head presentation use the left hand whenever possible. Other operators again will use the hand corresponding to the position of the limbs—the right hand if the limbs are on the patient's left, the left hand if the limbs are on the patient's right. The selection of the hand is of little importance, save that it is wise to use the hand that gets into the required position most easily and with the least cramp.

Still more divergent opinions have been expressed with regard to the foot that is to be drawn down. Sir J. Simpson, Barnes, Playfair, and almost all the older English writers, recommend that in transverse presentation the upper foot, *i.e.*, the foot belonging to the opposite side to the presenting shoulder, should be seized (*v.* Fig. 425), on the ground that by pulling upon it a more complete rotation of the fœtus round its longitudinal axis can be produced. On the other hand, other writers, notably Winckel and Galabin, recommend that the lower foot be seized, on the ground that the rotation that is thus caused is less complicated. As we have already said, we consider that there is no special advantage to be gained by selecting either one or the other, and that the correct foot to seize is the one that comes first to our hand.

The final step of the operation—the pushing up of the head to the fundus of the uterus—is a most essential one. The immediate result of drawing the foot down is that the presentation becomes, in most cases, the complex one of a foot and a head, or sometimes of a foot, a hand, and a head (*v.* Fig. 426), and, if this was allowed to persist, delivery would be impossible. Accordingly, the head must be pushed up to the fundus, usually with the external hand, and a longitudinal lie of the fœtus thus obtained.

β If the lateral position instead of the dorsal is chosen for the operation, the patient is placed upon the same side as that to which the feet are turned, whatever may be the presentation of the fœtus, and the opposite hand is introduced, *i.e.*, if the feet are on the left side of the uterus, the patient lies on her left side, and the operator introduces the right hand.

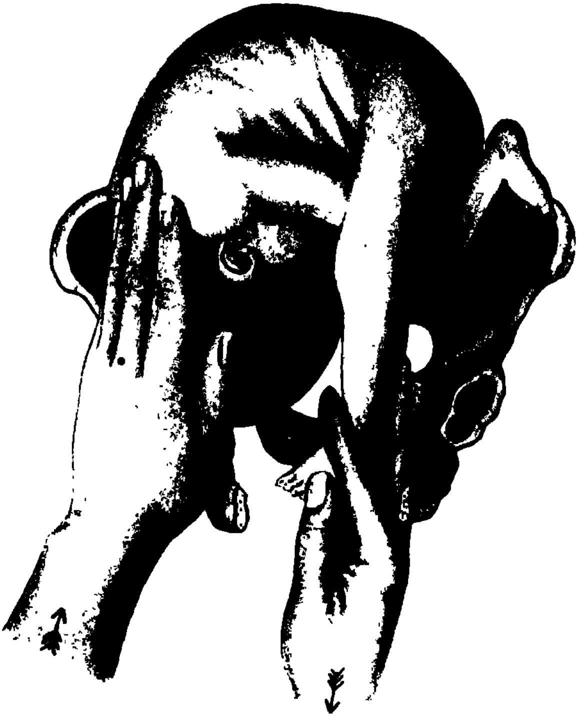

FIG. 426.—INTERNAL VERSION

The foot is drawn into the vagina with the fingers of the right hand, while the left hand pushes the head towards the fundus.

γ We must now describe the complete operation in the case of a transverse lie of the fœtus in a little more detail. The patient is anæsthetised and placed in the dorsal cross-bed position. The operator sits on a low stool in front of her, and introduces the hand which he considers most suitable, taking care to keep

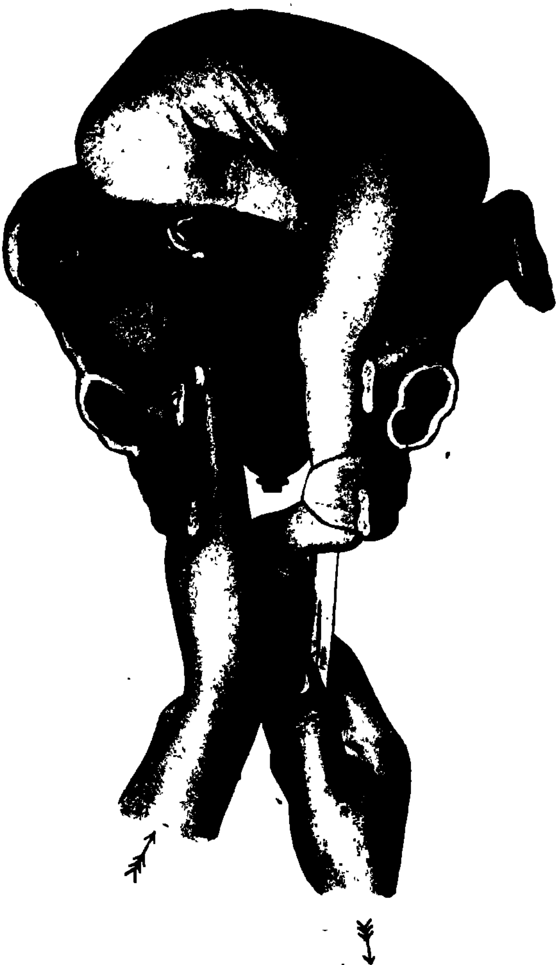

FIG. 427.—INTERNAL VERSION.

The right hand outside the vagina draws down the foot by means of a fillet applied round the ankle, while the fingers of the left hand in the vagina push the head upwards.

inside the amniotic sac. The use of rubber gloves is a distinct advantage, as it ensures asepsis, and, if they are kept wet in lysol solution, makes the hand smoother and diminishes friction. The operator then seizes the foot that first offers itself, and draws it down towards the uterine orifice, while at the same time by pressure with the external hand applied over the abdominal wall the breech is pushed upwards and towards the side at which the feet lay (*v.* Fig. 425). By this means, the fœtus is brought into the position shown in Fig. 426, and the foot is brought into the vagina. The external hand is then placed on the fœtal head and pushes the latter directly upwards, while, at the same time, the foot is drawn more deeply into the pelvis. As soon as the head has been pushed into the fundus, version is complete.

If the case is one of neglected shoulder presentation, the performance of internal version may be most difficult or even impossible, owing to the difficulty of effecting the final step of the operation and pushing the head up to the fundus. If the method of doing so, which we have just described, fails, the plan shown in Fig. 427 may be adopted with success. A fillet of iodoform or sterilised gauze is passed over the foot which has been drawn down into the vagina and fixed round the ankle by a clove hitch. The ends of the fillet are brought outside the vagina and held in the right hand, so that, by applying traction to them, the foot can be brought down without the necessity for introducing the hand into the vagina. This leaves the latter free for the introduction of the left hand, and, with the fingers, the head is pushed upwards from below, while at the same time an assistant also presses it up from outside. In this way, we have three forces uniting to complete version, the vaginal foot is being drawn down by the right hand, the head is being pushed up from the vagina with the fingers of the left hand, and is also being pushed upwards externally by the hand of the assistant.

In most cases of neglected shoulder presentation, the hand corresponding to the presenting shoulder has prolapsed into the vagina. In these cases, a gauze fillet should be slipped over the wrist, in order that subsequently, during the expulsion of the fœtus, the arm may be kept by the side of the body and prevented from slipping upwards beside the head. It is unnecessary to make any efforts to replace the arm prior to the performance of version. The hand may be introduced into the uterus beside it, and then, as the breech is brought down and the head pushed up, the arm will be drawn upwards by the rotation of the fœtal body.

THE EXTRACTION OF THE FŒTUS IN PELVIC PRESENTATION

In the following sections, we shall discuss the delivery of the fœtus when it presents by the pelvic pole, and when the conditions of the case call for assistance to the natural efforts. These procedures are analogous to the delivery of the fœtus by the forceps when the cephalic pole presents.

Indications.—The indications for extraction in pelvic presentation are almost identical with those already given for extraction by the forceps in cephalic presentation, and may be divided into the following groups :—

(1) Indications that the life of the fœtus is in danger, as shown by the rising of the rate of the fœtal heart above 160 or its falling below 120; tumultuous movements of the fœtus; and the coming away of meconium while the breech is still above the brim.

(2) Certain cases of prolapse or presentation of the cord.

(3) The appearance of the symptoms of threatened rupture of the uterus.

(4) The occurrence of complications which threaten the life of the mother, such as certain cases of ante-partum hæmorrhage, or eclampsia.

(5) The presence of maternal organic disease necessitating the shortening of labour, as in certain cases of cardiac, renal and pulmonary disease.

(6) Failure of the natural efforts to effect delivery in consequence of uterine inertia, obstruction to the passage of the breech at the pelvic brim, or impaction of the breech in the pelvic cavity.

In order that extraction may be successfully accomplished, the pelvis and vaginal canal must be of sufficient size to allow the passage of the fœtus, if necessary, after reduction by crushing or embryotomy; and the cervix must be sufficiently dilated.

Operation.—The extraction of the fœtus in a pelvic presentation may be divided into three distinct procedures :—The extraction of the pelvic pole; the liberation and delivery of the arms; and the delivery of the after-coming head.

If we are compelled to adopt the first procedure, the others are usually also necessary, and, sometimes, even when the pelvic pole of the fœtus has been expelled spontaneously, the second or third procedure or both have to be adopted.

The Extraction of the Pelvic Pole.—The patient is placed in the dorsal cross-bed position. If the pelvis and the vagina are roomy, or if the patient is a multipara, and if the breech is not impacted, the administration of an anæsthetic is not necessary, but, as a rule, it is advisable, and, if the case presents any difficulty, is essential. The first step of the operation is to ascertain the part of the child on which traction can be made, and the means by which it can be best applied, in the particular case with which we are dealing. Traction can be best applied by pulling with the hands on one or both of the legs of the fœtus, and this course is usually possible if the breech is not impacted in the pelvic cavity. If the breech is so impacted, traction can be best applied by the fingers hooked into one or both groins, or by a gauze fillet passed over a groin, and pulled on with the hands outside the vagina. Accordingly, in all cases, if the foot is not already presenting, our first object is to ascertain whether it is possible to bring it down into the vagina. This can always be done when the breech is still at the pelvic brim, but, after it

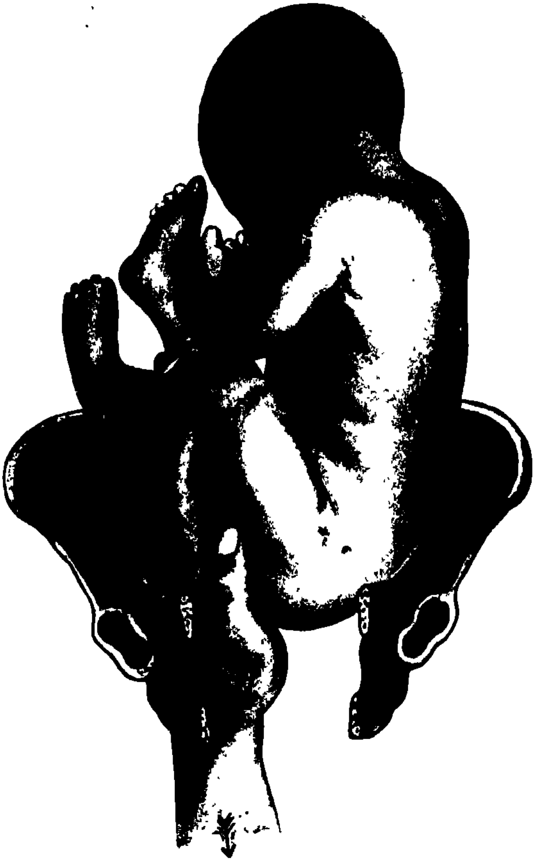

FIG. 428.—THE EXTRACTION OF THE PELVIC POLE OF THE FŒTUS: BRINGING DOWN A LEG.

The fingers of the left hand in the uterus flex the leg by pressure below the knee.

has descended into the pelvis, it is rarely possible. To bring down the foot, the hand corresponding to the side at which the feet lie, *i.e.*, the left hand if the feet are on the mother's right side, and *vice versâ*, is passed into the vagina, and the fingers pushed

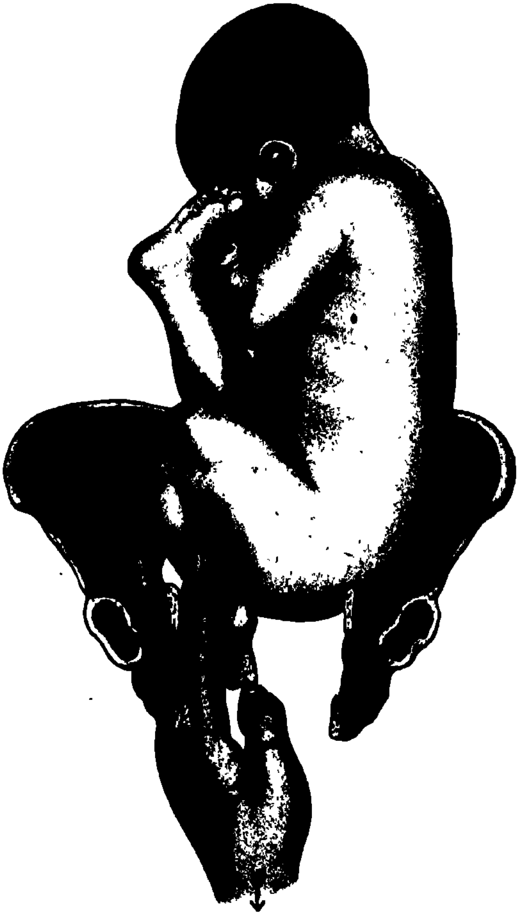

FIG. 429.—THE EXTRACTION OF THE PELVIC POLE OF THE FŒTUS. BRINGING DOWN A LEG.

The fingers of the left hand in the vagina draw the foot through the uterine orifice.

upwards between the thigh and the uterus as shown in Fig. 428. If the pelvic presentation is complete, *i.e.*, if the feet lie beside the thigh, the foot is at once reached and can be seized and drawn downwards. If, however, the legs are extended, then it is necessary to push the fingers farther upwards into the uterus until the lower leg is reached. Then, two fingers are hooked over the

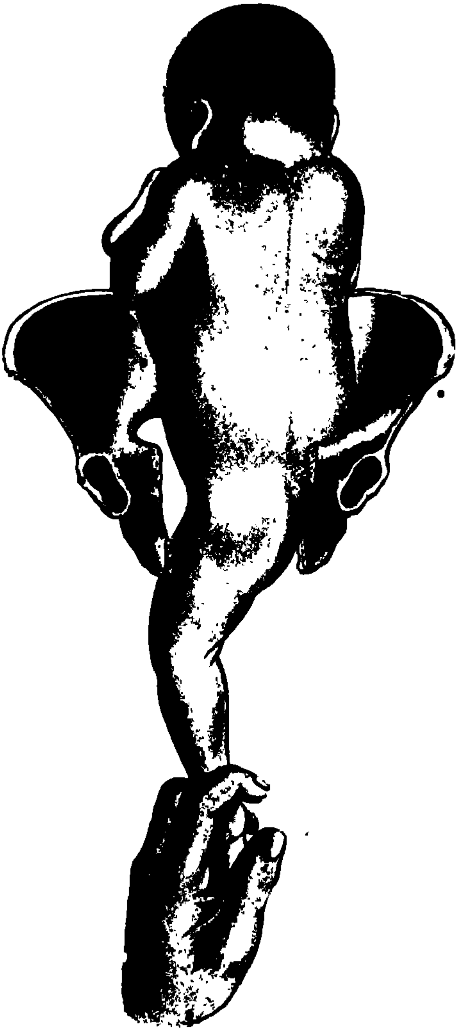

FIG. 430.—THE EXTRACTION OF THE PELVIC POLE OF THE FŒTUS. TRACTION ON THE LEG.

anterior aspect of the leg, and by gentle pressure the leg is flexed at the knee and the foot brought into the neighbourhood of the pelvic brim. The foot itself can be then caught in the fingers and drawn downwards as shown in Fig. 429. This procedure has the double effect of bringing the foot down and so enabling traction to be made upon it, and of lessening the size of the presenting breech by the thickness of the thigh. Traction is then made on the foot, at first in the axis of the pelvic brim, and later, as the breech descends, in such a direction as to follow the curve of the pelvis (*v.* Fig. 430). If the breech refuses to advance, the hand must be again introduced and the other foot brought down, so as to still further reduce the size of the presenting part. If the skin of the foot is so slippery that a firm grip cannot be obtained, it is well to cover it with a soft cloth, and this also serves to prevent the occurrence of abrasions.

β If the breech has entered the pelvic cavity, it is seldom possible to bring down the foot, and, consequently, we must resort to other means of applying traction. This is most readily done by hooking the fingers into the groins and pulling upon the latter. At first, the anterior groin alone is within reach, and the index-finger or the index and middle fingers passed upwards between the breech and the anterior pelvic wall are hooked over it, and traction applied (*v.* Fig. 431).a The amount of force that can be applied in this way is not very great, but still is sometimes sufficient. The strength of the fingers can be considerably increased by grasping the wrist of the same hand firmly with the other hand, as an additional support is thus given to the flexor tendons. If the anterior groin is drawn down a little way, it will be then found possible to pass the fingers in a similar manner into the posterior groin, and to draw it down. In this manner, by alternate traction on each groin, the breech is brought down to the pelvic floor, and, as soon as this is done, it will be perhaps possible to get a finger into both groins simultaneously (*v.* Fig. 432). In all cases, care must be taken that the finger is placed in the angle of the groin, and traction made directly down into the angle in such a manner as to avoid any outward pull on the femur, as such a force would be very likely to cause the fracture of the latter.

b If the breech is so firmly impacted in the pelvis that it resists these efforts, some method must be adopted by which stronger traction can be applied. There are various methods of doing this, but their adoption means a greatly increased risk of injury to the fœtus. The safest method consists in passing a fillet of gauze over the groin, and bringing the ends outside the vagina, but the application of the fillet is often a matter of difficulty. The easiest manner of applying it is as follows:—Take a small piece of double gauze about eighteen inches long and two inches wide, and rolled like a bandage. The free end of this roll is held in the left hand, and the roll itself is pushed upwards between the thigh and the anterior pelvic wall, in such a manner that as it advances it unrolls. As soon as it has been pushed above the angle of the groin, it is pushed inwards across the latter until it comes to lie between the thighs. Then, the fingers are pushed upwards from below between the thighs, and the roll of gauze caught and drawn downwards. If the first piece of gauze which was introduced is not sufficiently strong, a stouter piece can be knotted to one end of it and drawn over the groin. Traction is then applied to the ends of the gauze, taking care that it is made as shown in Fig. 433, that the gauze comes well down into the angle, and that there is no outward strain on the femur. Another method of applying the gauze consists in using a catheter as a *porte-fillet*.

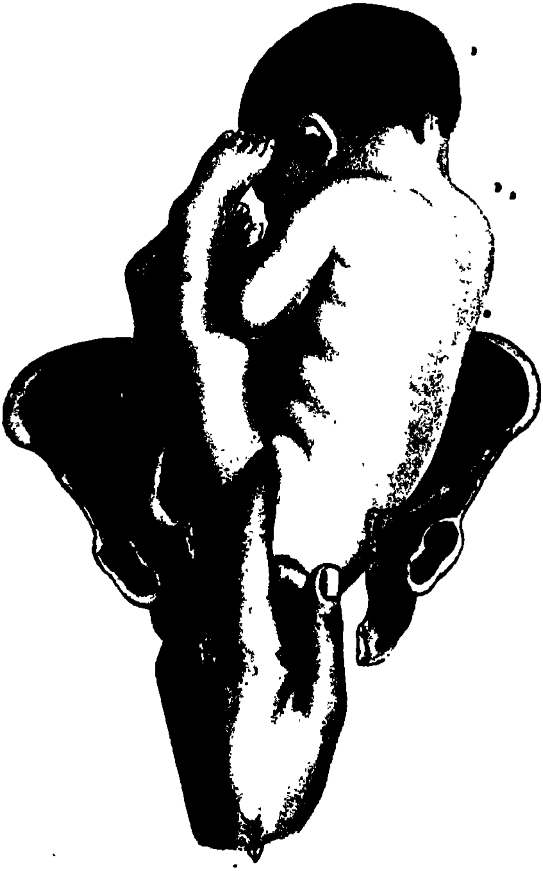

FIG. 431.—THE EXTRACTION OF THE PELVIC POLE OF THE FŒTUS BY TRACTION ON THE ANTERIOR GROIN.

The finger of the left hand hooked into the anterior groin endeavours to pull the latter down.

Take an ordinary No. 10 or 12 gum-elastic catheter with a strong stylette, thread it with a piece of stout silk or twine, and bend its upper end into a semicircle corresponding in size to the circumference of the thigh. Then, slip the catheter upwards anteriorly until the tip can be guided over the groin, and lies somewhere near the symphysis of the fœtus. Hold the stylette by the ring,

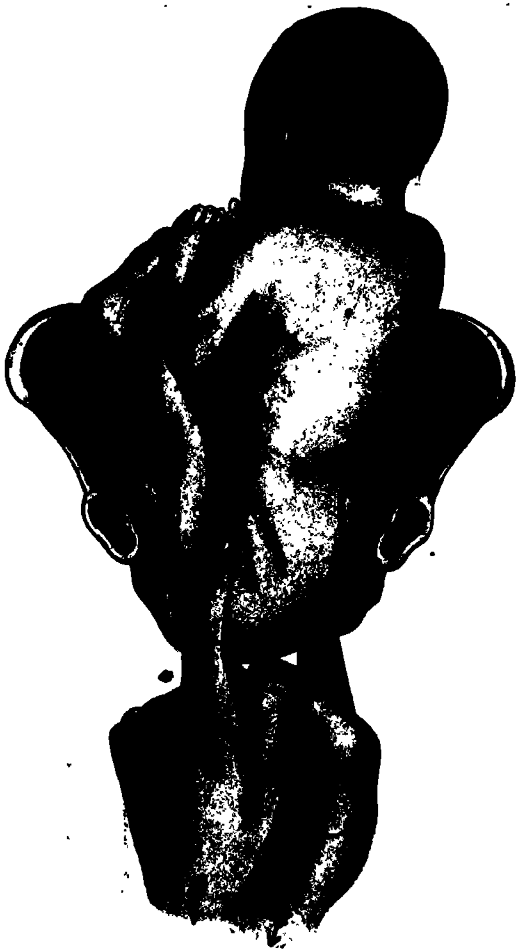

FIG. 432.—THE EXTRACTION OF THE PELVIC POLE OF THE FŒTUS BY TRACTION ON BOTH GROINS.

The breech has been brought down to the pelvic outlet, and an index finger is hooked into each groin.

and push the catheter itself gently upwards, and the curve which has been given to the stylette will guide the tip of the catheter downwards between the thighs, where it can be reached with the fingers. The end of the silk is caught and knotted to a piece of

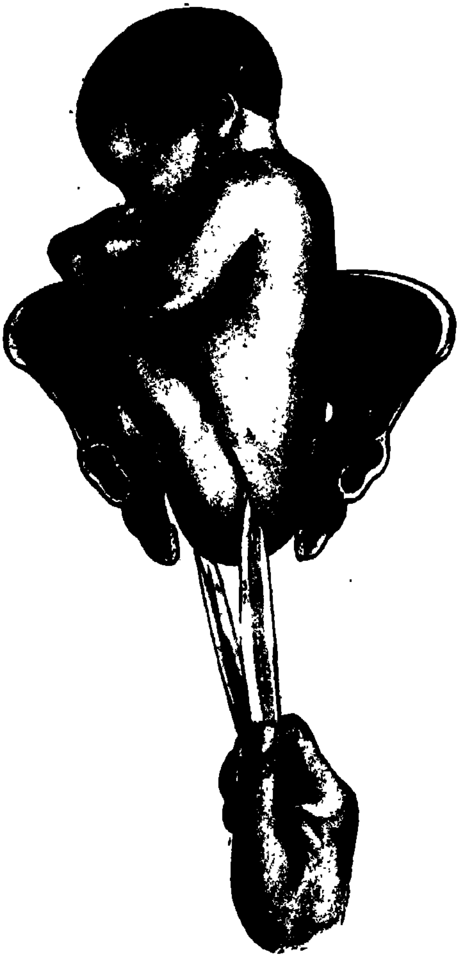

FIG. 433.—THE EXTRACTION OF THE PELVIC POLE OF THE FŒTUS BY MEANS OF A GAUZE FILLET APPLIED OVER THE ANTERIOR GROIN.

gauze, which is then drawn up to the eye of the catheter by means of the silk. The catheter and stylette are next gently withdrawn, and, at the same time, the gauze is carried over the groin.

If the breech cannot be extracted by these measures, it is most unlikely that the fœtus can be delivered without sustaining serious and perhaps fatal injuries, and, consequently, the methods which we are about to describe should not be adopted unless the fœtus is dead, or all other means of extraction have failed. These methods are the use of the blunt hook, the application of the forceps, or the cephalotribe. 1 The blunt hook is applied usually over the anterior groin, and traction is then applied as in the case of the fillet. For the fœtus, it is always a dangerous instrument, as the point of the hook may cause considerable abrasion of the skin, or may even open the femoral vessels. Further, in the hands of an unskilful operator, it may cause injury to the maternal soft parts. We have ourselves no experience of its use, but it does not seem to offer any advantages over the fillet, while it is very much more dangerous. If the fillet cannot be applied, the blunt hook might be tried. It is, however, an instrument which is very seldom carried in the modern obstetrical bag. If it is used, care must be taken to bring the point of the hook down between the thighs in such a manner that it presses as little as possible on the fœtal tissues, and is not in contact with the maternal soft parts. 2 The forceps has been recommended by many writers as a means of effecting delivery in these cases, and notably by Lusk, but at the present time there are not many advocates of its use. It possesses the disadvantage that it is ill adapted for seizing the breech, and that consequently it must be screwed up so tightly, to prevent it from slipping, that it will almost certainly injure the fœtus. If, however, all other means have failed, and the life of the fœtus cannot be saved, it may enable delivery to be effected. In such cases, it is applied as nearly as possible over the thighs of the fœtus. 3 The last instrument, to which we may be compelled to resort in cases of marked disproportion between the size of the breech and the pelvis, is the cranioclast. It is to be applied in relation to the bi-trochanteric diameter of the pelvis, and by crushing and reducing the size of the latter may enable delivery to be effected.

Whatever method of extracting the breech is adopted, it must be supplemented by firm pressure over the uterus, made in such a direction as to push the fœtus downwards into the pelvic brim.

3 **The Liberation and Delivery of the Arms.**—In all cases in which the arms become extended, and, leaving their normal position, pass upwards beside the head, it is necessary to bring them down again before proceeding to deliver the head. The bringing down of extended arms is always a delicate operation. In most cases, there has been already some delay, and it is now necessary to complete delivery as rapidly as possible, or the life of the fœtus will be lost; but, if in our efforts to save time any manipulation is performed in an improper manner, there is a great risk of fracturing the humerus or the clavicle. In some cases, indeed, it may be impossible to avoid such an accident,

but in the greater proportion of cases, skill and knowledge of the manipulations necessary will prevent its occurrence. The all-important point to remember is that pressure must be so made that the arm can respond to it by the natural movements permitted by the joints. A common mistake consists in pulling upon the centre of the humerus in such a direction that the arm can only respond to the force applied by fracture at the point of pressure. The arm may lie in one of several positions. It may be completely extended at both shoulder and elbow, it may be extended at the shoulder alone, or it may lie in front of the face or behind the head. The two most common positions are first where the arm is completely extended and lies straight upwards beside the head, and secondly where the whole arm is raised until the elbow lies at the level of the face, but the forearm is still flexed at the elbow. As the fœtus lies in the pelvis, the bis-acromial diameter more or less closely corresponds to one oblique diameter of the pelvis, and, consequently, one arm is posterior and in relation to the sacrum, the other arm anterior and in relation to the pubes. The posterior is higher than the anterior, but there is sufficient room for the operator's hand in the hollow of the sacrum, and there is but little room behind the pubes. Moreover, when the patient is in the dorsal position it is easier to pass the hand into the vagina along the curve of the sacrum, than behind the symphysis. Accordingly, in almost every case it is easier first to bring down the posterior arm.

This procedure is carried out as follows:—The obstetrician stands or sits in front of the patient, and passes the hand, which corresponds to the side towards which the face of the child is turned, into the vagina. The fingers are slipped upwards along the thorax until the posterior shoulder is reached, and then along the humerus until they come to the elbow (*v.* Fig. 434). If the arm is completely extended and stands vertically upwards beside the head, the tips of the fingers press upon the extensor surface of the forearm below the elbow in such a manner as to cause the forearm to flex, while at the same time the entire arm is swept across the face by gently carrying it forwards and downwards. In some cases, the arm will come down most easily with the angle of the elbow pointing downwards and inwards, in other cases it will come most easily with the angle pointing upwards and outwards. If the arm is only partially raised, and is flexed at the elbow, it can easily be brought down by hooking one or two fingers into the angle of the elbow and drawing the latter downwards over the chest.

The anterior arm must be next brought down. This can be done in two ways, either the arm can be brought down from the position it occupies behind the pubes, that is as an anterior arm, or the body of the fœtus can be so rotated that the arm comes to lie posteriorly, when it can be brought down in the manner just described. The difficulty of reaching the arm when it lies anteriorly has been already mentioned. It can to a certain extent be overcome by a manipulation which we shall presently describe, but even then the proceeding is not easy. There is no difficulty in rotating the fœtus until the anterior arm becomes posterior, but there are two objections. In the first place, if the head of

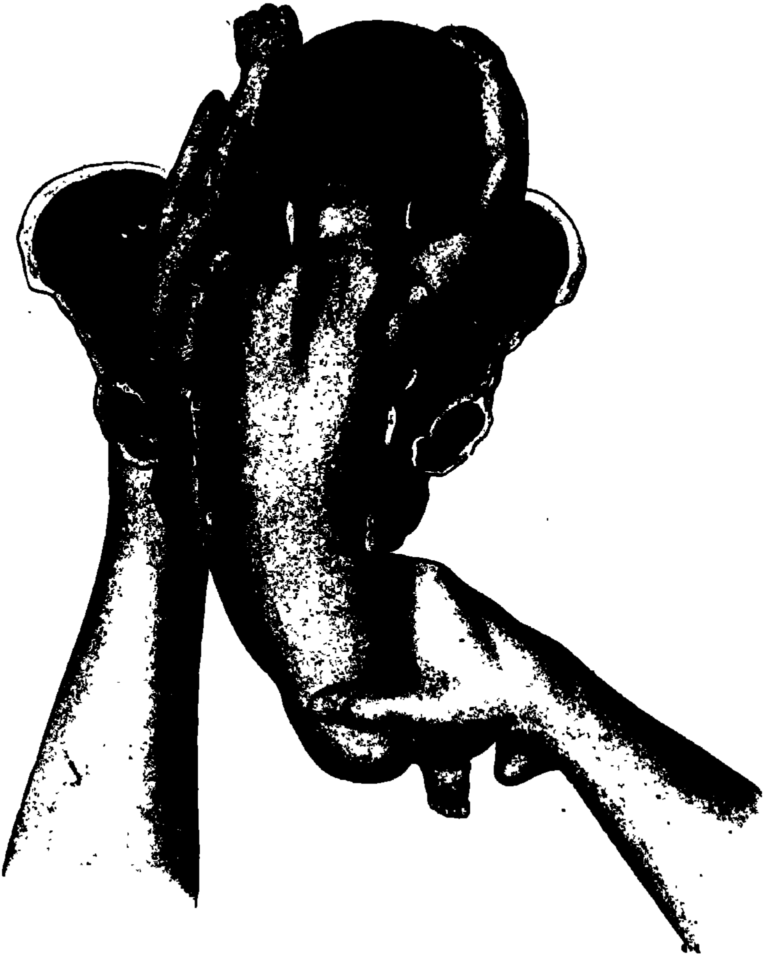

FIG. 434.—THE LIBERATION OF THE ARMS IN PELVIC PRESENTATION.

The body of the fœtus is drawn slightly to the left, and the operator passes his right hand into the uterus to bring down the posterior arm.

the fœtus is fixed it is not safe to rotate the body through more than a quarter of a circle, as by so doing the ligaments of the articulations of the axis and the atlas vertebræ may be ruptured, and the spinal cord compressed with a fatal result. If, however, the head of the fœtus is above the brim and is free to move, the body may be safely rotated to any desired extent. In the next place, if the rotation is so made that the anterior shoulder is carried in the direction of the chest of the fœtus, the arm may be carried behind the head, and the case made more difficult

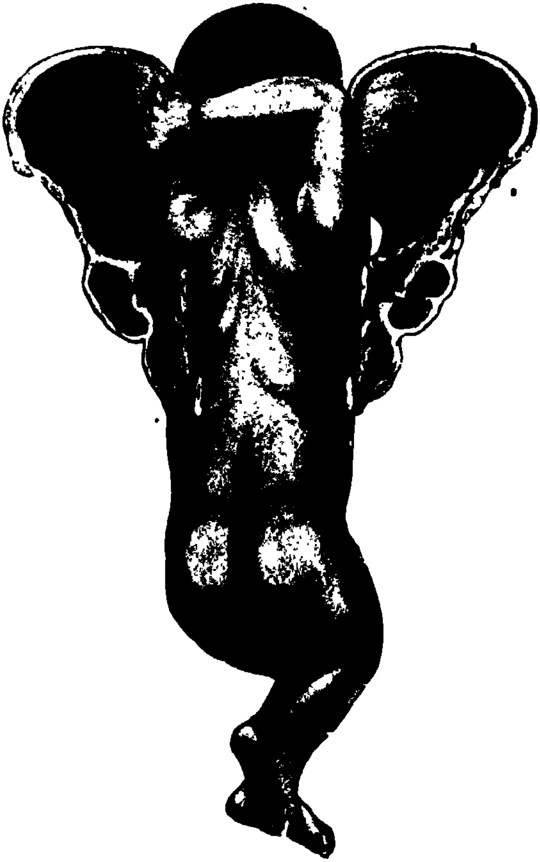

FIG. 435.—THE NUCHAL POSITION OF THE ARM.

than it was before. Rotation in this direction is unnecessary if the fœtus lies with its back directed posteriorly, *i.e.*, in either the third or fourth position of Naegele, as then the anterior shoulder can be made posterior by rotating the body through a quarter of a circle in such a direction that the anterior shoulder moves in the direction of the fœtal back. Also, when the back lies anteriorly, and the head is free above the brim, a similar result can be obtained by rotating the body in the same direction but through half a circle. Such a rotation will further facilitate matters by bringing the arm more directly in front of the face of the fœtus. If, however, the head is not free to move, the long rotation cannot be performed, and consequently we must make a choice between performing the short rotation and perhaps carrying the arm behind the head of the fœtus, or bringing down the arm as an anterior arm. Under such circumstances, perhaps the best rule to adopt is to perform the short rotation in the direction of the back when the latter lies posteriorly, and then to bring the arm down as a posterior arm; and, if this cannot be done, to bring the arm down as an anterior arm. To do this, draw the body of the child as far backwards as possible and pass as much as is necessary of the hand, which corresponds to the side towards which the face is turned, upwards between the body of the fœtus and the symphysis until the elbow is reached. Then, sweep the arm across the face of the child, at the same time flexing the forearm at the elbow as has been described.

Two manœuvres have been described by Barnes* which will facilitate the bringing down of the arms. The first is performed with the object of gaining room In bringing down the posterior or sacral arm 'carry the child's body well forward, bending it over the symphysis pubis. The effect of this is a twofold advantage. Space is gained between the child's body and the sacrum for manipulation; and as the child's body revolves round the pubic centre, the further or sacral arm is necessarily drawn lower down and commonly within reach. When the sacral arm is freed, you reverse the manœuvre, and carry the child's trunk backwards over the coccyx as a centre. This brings down the pubic arm.' The second manœuvre is of use in cases in which either arm has been carried slightly behind the head. 'You grasp the child's trunk in the two hands above the hips, and give the body a movement of rotation on its long axis, so as to bring its back a little to the left' (the patient's left). 'The effect of this is to throw the pubic arm, which is prevented by friction from following the trunk in its rotation, across the breast. Then, your object being accomplished so far, you call to your aid the first manœuvre, and bring the arm completely down. This done, you reverse the action and rotate the trunk in the opposite direction. The sacral arm is thus brought to the front of the chest, and, by carrying the trunk back, your fingers will easily complete the process.' The direction here given so to rotate the body as to bring the back a little to the 'left,' is only applicable to the position in which the child lies with its back anterior. To make the description more general, the direction should be, first, to rotate the anterior shoulder towards the back of the child, and, then, the posterior shoulder in the opposite

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* 'Obstetric Operations,' third edition, p. 208.

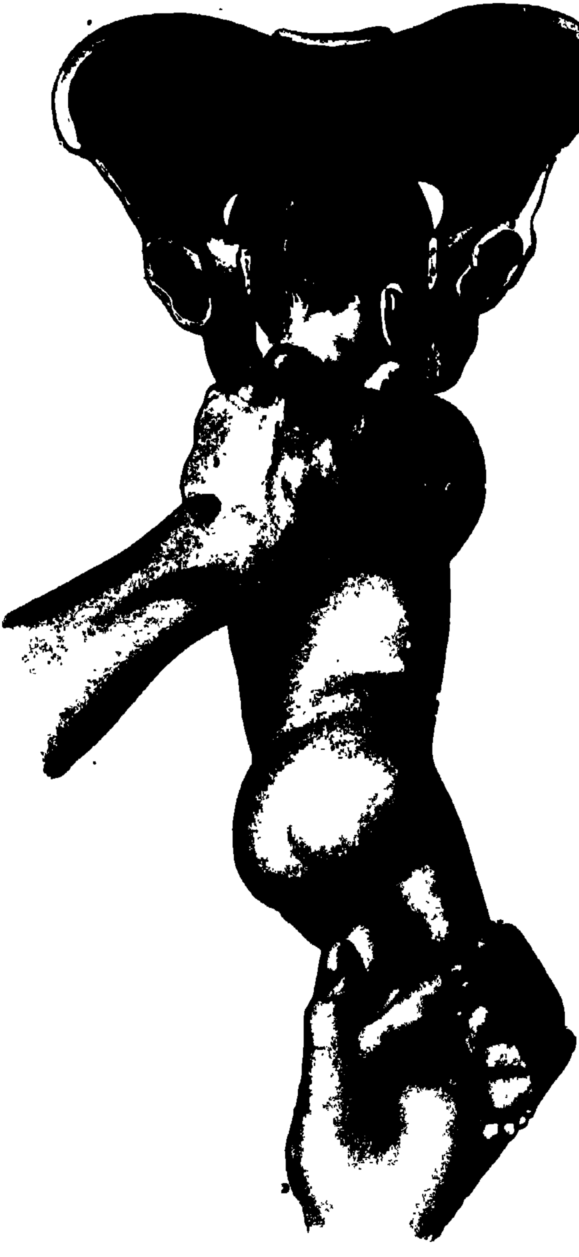

FIG. 436.—THE EXTRACTION OF THE AFTER-COMING HEAD. THE MODIFIED PRAGUE METHOD.

direction. The extent to which the rotation is carried need never, according to Barnes, exceed one-eighth of a circle.

In some cases, the arm becomes so displaced behind the back of the head that it actually lies below the occiput—the so-called nuchal position or dorsal displacement of the arm (*v.* Fig. 435). It is doubtful if in such cases rotation of the body would ever bring the arm forwards, as the forearm would be carried round by the pressure of the occiput as the fœtus is rotated. In such cases, Herman[*] recommends to pass the hand along the back of the child, seize the elbow and draw it downwards and forwards. It is, however, probable that, if the life of the child is to be saved, the arm must be fractured in order to get it down sufficiently quickly.

The Delivery of the After-coming Head.—In all cases in which the head is not expelled by the same or the next contraction to that by which the shoulders are expelled, assistance will be required, or the fœtus will run the risk of asphyxiation. Consequently, in many cases of pelvic presentation in which the mechanism of expulsion has been in every other way normal, the after-coming head requires to be delivered artificially. The number of different methods of doing this is so considerable that Winckel was able to give a list of twenty-one distinct methods, which have been recommended from time to time by different obstetricians. Experience has, however, shown that the most reliable and satisfactory of these are the three methods which we shall now describe, and consequently the others possess but an academic interest. Before proceeding to describe them, we may insist on one very obvious point. Any method to be satisfactory must be capable of being carried out with rapidity, and must bring the head through the pelvis in a manner similar to the normal mechanism of expulsion.

The Prague Method.—In this method, which was originally described by Kiwisch,[†] the operator grasps the feet of the child with his right hand, while he hooks the fingers of his left hand over the shoulders as shown (*v.* Fig. 436). The fœtus is then drawn forcibly downwards, until the base of the occipital bone lies behind the lower margin of the symphysis. The legs are carried forwards and swung as far upwards over the abdomen as possible, and, by combined traction on the feet and shoulders, extraction is accomplished. It is essential in doing this to maintain flexion of the head. The original Prague method maintains flexion by pressure upon the occiput with a couple of fingers of the left hand, but a more suitable method and one which offers a better chance of success consists in so directing the traction made by the left hand that the occiput will be pressed against the back of the pubes and the head kept by this pressure in a position of flexion. With this object, the Prague method may be modified as follows:—Having grasped the child as has been described, before applying any traction downwards draw the body directly forwards with the hand which holds the shoulders. By

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[*] *Op. cit.*, p. 50.

[†] *Beiträge z. Geburtskunde*, vol. i., p. 69.

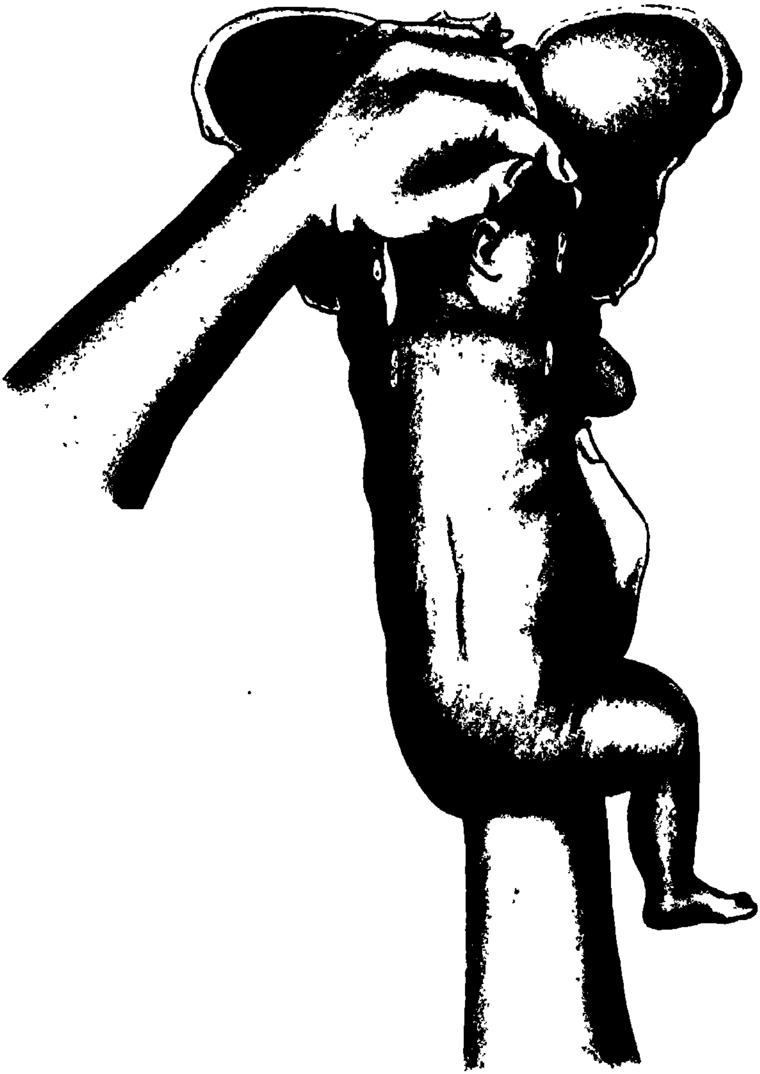

FIG. 437.—THE EXTRACTION OF THE AFTER-COMING HEAD
MARTIN'S METHOD.

this means, the occiput is pressed against the back of the symphysis. Then, sweep the legs and body forwards over the abdomen of the mother, and in this way the head will be made to pivot round the point of the occiput which is pressed against the pubes, while at the same time it maintains its flexed attitude. Either form of the Prague method is, however, only suitable in cases in which the head has passed through the brim and lies in the pelvic cavity. Then, on account of the ease and rapidity with which it can be performed, it is a suitable method to adopt.

Martin's Method.—This method, which is also known as the *Wigand*[*]*-Martin*[†] *method, is thus described by Winckel. The first and second fingers of the hand whose palm corresponds to the face are introduced into the mouth, and the lower jaw is* directed to the middle of the pelvis, after which the child's body is placed astride of the arm, and then the fœtal head is forced down through the small pelvis by pressing upon the occipital region (*v.* Fig. 437). The seizure of the chin serves less for traction than for directing the passage of the head, which latter is accomplished mainly by expression. While this pressure upon the occiput in the direction of the brow is continued, the head is rotated about its transverse axis, and at the same time turned somewhat about its sagittal axis, so that the chin descends nearly in the median line, and the parietal bone, which was directed posteriorly, is pushed down under the promontory. In carrying out this method, the antero-posterior diameters of the head must be guided into the oblique diameter of the brim, or in the case of a flattened pelvis into the transverse diameter, and then into the transverse diameter of the outlet as the floor of the pelvis is reached. This is a most suitable method for use in all cases, and especially in those in which the head is above the brim. Champetier de Ribes[‡] and Ruge[§] have succeeded in delivering a head by this means in which Smellie's method failed, and Winckel[||] states that he has brought the head of a fully-developed child through a pelvis with a conjugate of six centimetres ($2\frac{3}{8}$ inches) in from fifteen to seventy-five seconds, but such a procedure can only be possible under very exceptional circumstances.

Smellie's Method.—This, the last method of extraction of the head which we shall describe, has been attributed to, and called after, many famous obstetricians. At the present time, it is most usually known as the Veit-Smellie method, but inasmuch as Smellie[¶] described it in the eighteenth century and Veit not until 1863, of the two the former would appear to have clearly the better claim to the credit. Mauriceau[**] had, however, described it at an earlier date even than Smellie, namely in 1668, and consequently his name should in reality be affixed to the method. The names of Smellie and Veit have now become so intimately associated with the method that to call it by any other name save their name would lead to confusion. The

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[*] *Berlin Klin. Wochenschrift*, 1886, p. 660.

[†] *Beiträge zur theor. und prakt. Geburts.*, Heft II., p. 118, Hamburg. 1800.

[‡] 'Du passage de la tête fœtale,' etc., p. 78, Experience IX., 1879.

[§] *Zeitschr. f. Geburts. und Frauenkrank.*, v. E. Martin, vol. i., p. 82, 1876.

[||] *Op. cit.*, p. 691.

[¶] 'Midwifery,' New Sydenham Society's edition, vol. i., p. 307, and vol. iii., Case 303.

[**] 'Traité des mal. des femmes grosses,' dernière édition. Paris, 1668.

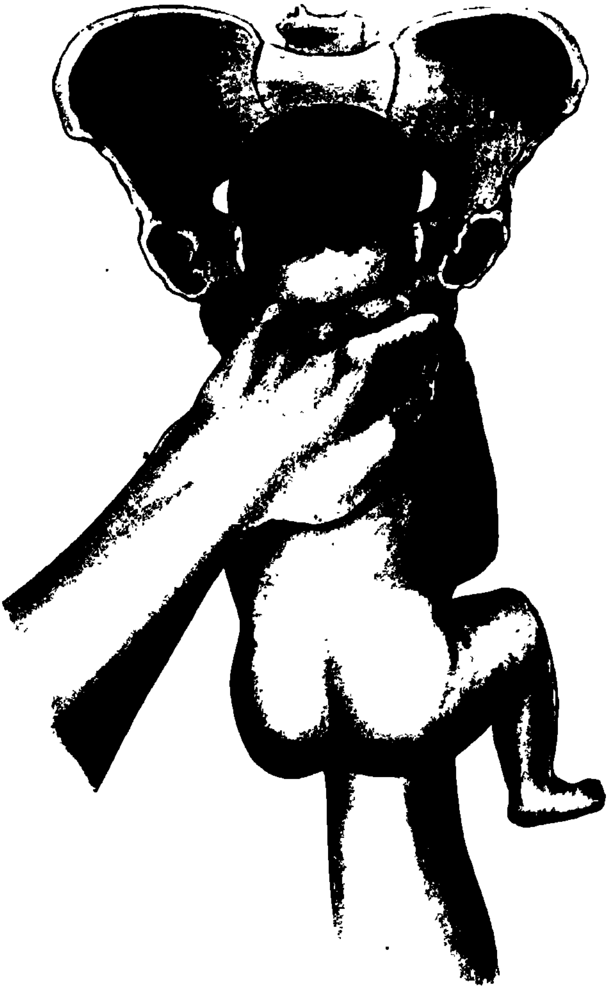

FIG. 438.—THE EXTRACTION OF THE AFTER-COMING HEAD. SMELLIE'S METHOD

manner in which the fœtus is seized is, as it were, a combination of the Prague and Martin's method. The hand corresponding to the side towards which the face is turned is passed into the vagina, and two fingers introduced into the mouth. The latter are passed as far back as possible in order to avoid fracture of the jaw during traction and to obtain a firm hold. The body of the child is then placed astride of the arm. The position of this hand very much resembles that of the vaginal hand in Martin's method, but here it is used both for obtaining flexion and for traction. The fingers of the other hand are then passed over the shoulders of the child at each side of the neck as in the Prague method, but are used solely for traction (*v.* Fig. 438). The head is guided by the fingers in the mouth until its antero-posterior diameters correspond to the oblique diameter of the pelvis, or to the transverse diameter in the case of a flattened pelvis, and is pulled down into a position of flexion. Traction is next made with both hands, at first downwards and backwards to bring the head through the brim, then downwards, and finally, as the outlet is reached, the body is carried well forwards over the abdomen of the mother and the face rolled out from above the perinæum. As the head descends, its antero-posterior diameters must be guided from the oblique diameter into the antero-posterior of the outlet, as in Martin's method. If extra force is required, it can be obtained by getting an assistant to press upon the head of the fœtus through the abdominal wall, as in Martin's method, and, in this way, a method even more powerful than Martin's will be obtained.

A few words must be said regarding the application of the forceps to the after-coming head, though it does not appear to us that there is a large field for its use. In the case of a living child, Martin's or Smellie's method of extraction is more suitable and affords a better prospect of life to the child, since each of them can be adopted more rapidly, and at least as much force can be applied as by the forceps. Further, as the head can be better guided by the fingers into correspondence with the diameters of the pelvis than it can with the forceps, the effective part of the force applied is also greater in manual than in forceps extraction. If, on the other hand, the fœtus is dead, and extraction by Martin or Smellie's method has failed, it is preferable to perforate the head and then extract it, than, by applying the forceps, to subject the mother to the crushing of the soft parts which must result during the delivery of the head.

As we have mentioned, in certain cases the head may rotate so that the face is directed forwards. In such cases, one of two methods of delivery may be adopted. / If the face is lying behind the pubes, the body of the fœtus is carried as far backwards as possible, and the fingers are slipped into the vagina between the chin and the pubes until the mouth is reached. Then, by traction upon the jaw, as in Smellie's method, the face is pulled down from behind the symphysis, the body at the same time being still further depressed. In this manner, the face, the sinciput, and the vertex are in turn born, the occiput following last. ² If, however, the chin has become caught above the pubis, the delivery of the head is more difficult. In such cases, it may sometimes be possible to rotate the head in the manner suggested by Madame La Chapelle, by passing the hand upwards in the hollow of the sacrum until it lies over the occiput, and then carrying it round anteriorly in such a manner as to bring the occiput to the side. The head can be then delivered by any of the ordinary methods.

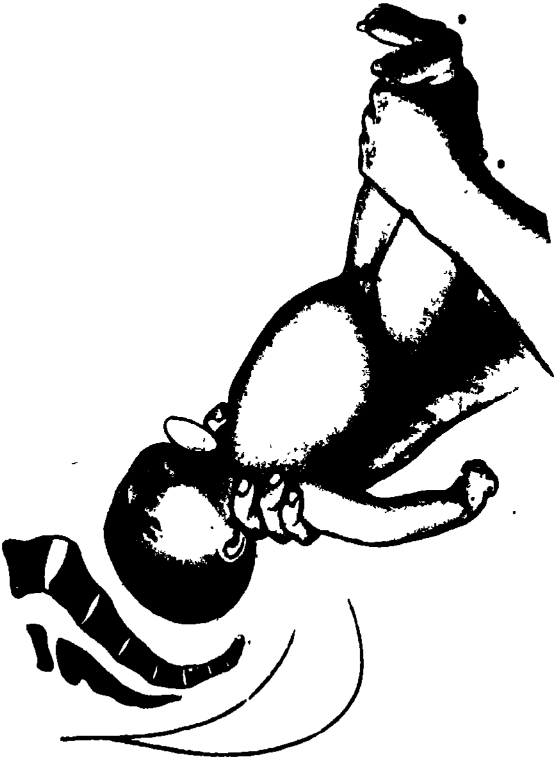

Fig. 439 —The Extraction of the After-coming Head in which the Face has Rotated Anteriorly and the Chin has caught above the Symphysis.

If this cannot be done, it may be possible to deliver the head by a process the reverse of the one we have described for use in cases where the face is behind the symphysis. The body of the child is carried as far forwards over the abdomen of the mother as possible and the occiput thus made to roll out from above the perinæum, the vertex, sinciput, and face successively following (*v.* Fig. 439). If this procedure fails, the child by this time will be dead and perforation should be performed.

CHAPTER IV

CONSERVATIVE AND RADICAL CÆSAREAN SECTION. SYMPHYSIOTOMY

Conservative and Radical Cæsarean Section—History of the Operation—Conservative Cæsarean Section—Radical Cæsarean Section, The Porro-Cæsarean Operation, Partial Hysterectomy, Complete Hysterectomy Symphysiotomy—History of Operation—Effect of Operation on the Pelvis—Indications—Instruments—Assistants—Operation—After-treatment—Prognosis.

CONSERVATIVE AND RADICAL CÆSAREAN SECTION

Under the terms 'conservative Cæsarean section' and 'radical Cæsarean section,' we propose to include all operations in which the fœtus is delivered through incisions in the abdominal wall and the uterus. In conservative Cæsarean section, the incision in the uterus is sutured after the removal of the ovum, and the uterus is allowed to remain. In radical Cæsarean section, the removal of the fœtus is followed by the removal of the uterus, either partially or completely. We thus use the term 'conservative Cæsarean section' as the equivalent of the term Cæsarean section—as usually used, and the term 'radical Cæsarean section' to designate the type of operation which is generally termed Porro's operation. The objection to adhering to the older terms is that Porro's operation, as devised by Porro, has to all intents and purposes passed out of modern obstetrical surgery, and that the limitation of the term Cæsarean section to cases in which the uterus is left behind is scarcely justified by its meaning.

The origin of the term Cæsarean section has given rise from time to time to a considerable amount of discussion, and many and widely different explanations of it have been brought forward. The most probable explanation is that the word Cæsarean is derived from *cæsus*, and was selected because the individual so delivered was *cæsus e matris utero*. Another possible explanation is that Numa Pompilius, in his code of laws, included one making it obligatory to remove the fœtus before burial in the case of all women who died in the last few weeks of pregnancy, and that this law was known as the Lex Regia. Under the emperors, it is said that the latter term was converted into Lex Cæsarea. If this was so, it offers a very reasonable explanation of the origin of the term.[*]

The first performance of Cæsarean section on the living woman is believed to have been carried out by a swine-gelder named Jacques Nufer, of Siegerhausen, in the year 1500 A.D.; and a very complete account of this and of the other earlier operations is to be found in a work[†] in defence of that operation written by John Hull, M.D., of Manchester, in 1858. Hull was able to collect the results of 137 operations, performed between the years 1500 and 1786, in 110 of which the mother recovered and in 27 of which she died. Hull's statistics were, however, collected with the object of proving the permissibility of the operation, and it is probable that he did not give the same prominence to unsuccessful as to successful cases, for, in 1867, Meyer[‡] collected the statistics of 1,605 cases, with a total mortality of 54 per cent. This terrible mortality was doubtless due to the non-suture of the uterine wound, and to hæmorrhage and sepsis. In 1876, the first step in the improvement of Cæsarean section was made when Porro[§] introduced the operation to which his name has been attached. In this operation, after the removal of the fœtus, the uterus was amputated above the vaginal insertion, and the stump sutured into the lower angle of the abdominal wound. Thus, hæmorrhage was prevented and the risk of sepsis was lessened.

The next great advance, and that which is responsible for placing Cæsarean section on its present firm basis, was the introduction by Sänger,[‖] in 1882, of the practice of suturing the uterine incision; indeed, so far as the operation of conservative Cæsarean section is concerned, few modifications of importance have been introduced since that date. The operation introduced by Porro has, however, been very considerably improved, and the technique of radical Cæsarean section, in which the greater part of the, or the entire, uterus is removed, has improved *pari passu* with the improvements in the operation of hysterectomy for myomata. Porro's operation possessed the great disadvantages that the risk of sepsis from the exposure and sloughing of the uterine stump was considerable; that the presence of the stump in the lower angle of the wound paved the way for the subsequent occurrence of ventral hernia; and that convalescence was protracted. In the modern operation of radical Cæsarean section, the uterus is either amputated above the vagina, and the stump ligatured and covered by peritoneum, or the entire uterus is removed.

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[*] Whatever may be the true origin of the term, we may say, with the object of removing a popular misconception, that there is no evidence to show that it arose in a supposed delivery of Julius Cæsar by Cæsarean section, or in the initial performance of the operation by an individual of the name of Cæsar.

[†] 'A Defence of the Cæsarean Operation, with Observations on Embryulcia and the Section of the Symphysis Pubis, addressed to Mr. W. Simmons, of Manchester, author of "Reflections on the Propriety of Performing the Cæsarean Operation,"' by John Hull, M.D., Manchester, 1858.

[‡] 'Sulla gastroisterotomia.' Napoli, 1867.

[§] 'Della amputazione utero ovarica,' etc. Milan, 1876.

[‖] 'Der Kaiserschnitt bei Uterusmyomen,' etc. Leipzig, 1882.

Indications.—The principal indication for Cæsarean section is obstruction to the passage of the fœtus through the pelvis. Such an obstruction may be due to pelvic contraction; to the presence of solid irreducible tumours; or to extreme cicatrisation of the vaginal tissues. If the obstruction is such that the passage of even a mutilated fœtus is impossible, and that symphysiotomy will not give a sufficient degree of enlargement to allow a living fœtus to be extracted, Cæsarean section is said to be absolutely indicated. If, on the other hand, it is possible to effect the delivery of the fœtus by other means, such as perforation or symphysiotomy, there is said to be a relative indication for Cæsarean section. The different indications may, accordingly, be grouped as follows:—

Absolute Indications.—(1) Absolute pelvic contraction, *i.e.*, a true conjugate of less than 2¼ inches in the case of a flattened pelvis, or of less than 2½ inches in a generally contracted pelvis.

(2) Solid irremovable tumours blocking the pelvis, as in the case of bony tumours springing from the pelvic walls, carcinoma of the cervix or vagina, uterine myomata springing from the lower uterine segment, and ovarian tumours impacted in Douglas' pouch.

(3) Extreme cicatrisation of the vaginal tissues sufficient to prevent the vagina from being dilated without the rupture of adjacent organs.

Relative Indications.—(1) Slighter degrees of pelvic contraction, *i.e.*, pelves which measure from 2¼ to 3¼ inches in the true conjugate in the case of flattened pelvis, from 2½ to 3½ inches in the case of generally contracted pelvis, provided that the fœtus is alive.

(2) Narrowing of the genital passages by tumours or cicatrisation where it is possible to extract a mutilated fœtus, but in which the fœtus is alive.

In the presence of absolute indications, Cæsarean section must be performed whether the fœtus is alive or dead, and whatever the circumstance under which the case is met. In the presence of relative indications, the operation is only indicated if the fœtus is alive, and its performance must be further governed by the circumstances under which the operation has to be performed. In consequence of the marked improvement which has taken place in the maternal prognosis after Cæsarean section, when performed by a skilled operator under favourable circumstances, Whitridge Williams advocates the extension of the limits for the performance of the operation in cases of contracted pelvis. He suggests* that the operation should be considered to be absolutely indicated in cases in which the true conjugate is less than $2\frac{3}{8}$ inches in flattened pelvis, or than 3 inches in generally contracted pelvis, and to be relatively indicated in cases in which it is less than $3\frac{2}{8}$ inches in flattened pelvis, or than $3\frac{1}{3}$ inches in generally contracted pelvis. He very properly adds, however, that the limits should only be thus extended in the case of patients in good condition, and in whom the operation can be undertaken under favourable circumstances.

In addition to the foregoing indications, Cæsarean section has been recommended in certain cases of eclampsia and of concealed accidental hæmorrhage, and numerous cases in which the operation has been successfully performed in the presence of these complications are to be found in medical literature. It is probable that the introduction of Bossi's dilator has considerably lessened the small number of cases in which Cæsarean section may be indicated in eclampsia; and it is possible that similar means of effecting delivery may also prove of value in those cases of concealed accidental hæmorrhage for which in the past there did not appear to be any treatment possible other than radical Cæsarean section.

Having considered the cases in which Cæsarean section is indicated, it remains to consider the circumstances which lead to the adoption of the conservative or the radical operation. It may be laid down as a broad principle, based on the excellent results obtained, that the conservative operation is the operation of choice in all cases in which the presence of some complication does not call for the removal of the uterus. In other words, the removal of a healthy uterus is no longer required in order to lessen the risk of operation. On the other hand, in certain pathological conditions, the removal of the uterus is called for after the extraction of the fœtus. The most important of these conditions are as follows:—

(1) Defective development of the uterus.

(2) The presence of uterine fibro-myomata or malignant disease, which would call for hysterectomy even if the patient was not pregnant.

(3) The presence of incurable and extreme cicatrisation of the vagina.

(4) If there is reason to believe that septic infection of the uterus has occurred.

(5) If severe ante-partum hæmorrhage has occurred, and there is reason to anticipate the occurrence of further hæmorrhage.

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* 'Obstetrics,' p. 402.

Cases in which the operation is performed on account of concealed accidental hæmorrhage fall under this head.

(6) Osteo-malacia, with the object of improving the prognosis of the disease.

In all cases, partial hysterectomy is the more rapid and easier procedure, but, in cases of malignant disease of the cervix or of septic infection of the uterus, total hysterectomy should be performed.

Preparation of the Patient.—If the operation is deliberately undertaken, the patient must be prepared as for an ordinary abdominal cœliotomy. Thirty-six hours before the operation she is given a brisk purgative, which is followed by an enema a few hours before the operation. On the evening before the operation, the patient is given a warm bath, the pubes is shaved, the skin of the abdomen is washed with soap and water and finally with ether, and a compress soaked in a one per cent. solution of corrosive sublimate in glycerine is applied over the proposed site of incision. This compress remains *in situ* until the patient is on the operating table, when it is removed and the skin again washed with soap and water, then with ether, and finally with corrosive sublimate solution, 1 in 500. If, however, as usually happens, the operation is undertaken in an emergency, the preliminary preparations must necessarily be dispensed with, and increased care must be taken with the washing and disinfection of the skin at the time of the operation. The vagina should be well douched, and washed out with lysol solution shortly before the operation, and, if a complete hysterectomy is to be performed, it is well, if it is possible to do so, to insert a tampon of iodoform gauze, after a preliminary douching, twelve hours before the operation. Finally, just before the patient is placed on the table, the catheter should be passed, unless it is certain that the patient has emptied the bladder spontaneously.

Time at which to Operate.—It is usually taught and practised that the best time to perform Cæsarean section is after the patient has come into labour, and prior to the rupture of the membranes. The presence of labour pains ensures that normal contraction and retraction will occur after delivery, and the fact that labour has been in progress for some little time ensures that the uterine orifice will be sufficiently dilated to allow the escape of the lochia. The advantages of operating while the membranes are intact are, first, that the uterine wall is slightly thinner, and that consequently so many vessels are not divided by the incision, and, secondly, that it is easier to deliver the fœtus when it floats freely in the uterus than when it is gripped by the uterine wall. There is, however, a grave objection to being guided solely by these two conditions as they frequently necessitate the performance of the operation at night, by artificial light. In consequence of this, Kelly[*] was led to neglect the older principles and to operate at the end of pregnancy without waiting for the onset of uterine contractions. His results by so doing were excellent, and he, consequently, recommends that, whenever the end of pregnancy can be accurately fixed by reference to the date of the cessation of menstruation or by the measurement of the fœtus, the operator should fix the day and hour for the operation, as in the case of any other operation. In such cases, however, some steps must be taken to dilate the cervical canal in order to provide for the free escape of the lochia during the puerperium. If it can be shown that proper contraction occurs after the emptying of the uterus in cases in which the patient was not in labour, there can be no doubt that the course recommended by Kelly is correct. His cases all show that due contraction does occur, as is to be expected in view of the fact that contractions occur after the emptying of the uterus *per vaginam* in cases of *accouchement forcé*.

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[*] 'Operative Gynæcology,' vol. ii., p. 417.

Instruments.—The following instruments are required:—Two scalpels; a dozen clip forceps; three pairs of scissors, one sharp-pointed, one blunt-pointed, and one curved on the flat, all tolerably stout and with handles of medium length; retractors; four or five long, straight and curved, narrow-bladed clamp forceps; six stouter clamp forceps with blades of different lengths; rubber gloves for operators and assistants; a couple of sponge-holders; two toothed fistula forceps; three or four dozen sponges of gauze; needles and holders; suture materials; two short, and two long, dissecting forceps with sharp teeth.

Assistants. — In addition to the operator, four assistants are required if they can be obtained. The chief assistant stands opposite and helps the operator. A second assistant attends to the ligatures and instruments. A third gives all necessary general help and attends to the infant after its removal. A fourth administers the anæsthetic.

Operations.—Four different operations must be described, three of which fall under the head of radical Cæsarean section. These are:—

(1) Conservative Cæsarean Section—the 'Sänger-Cæsarean' operation.

(2) Radical Cæsarean Section.
  (*a*) The classical 'Porro-Cæsarean' operation.
  (*b*) Partial hysterectomy.
  (*c*) Complete hysterectomy.

CONSERVATIVE CÆSAREAN SECTION. — The operation of conservative Cæsarean section consists in the opening of the abdominal cavity in the middle line, the incision of the wall of the uterus, the removal of the fœtus, and the suture of the uterine and abdominal incision. The steps of the operation, as usually performed, are as follows:—

(1) The abdomen is opened in the middle line by a longitudinal

incision about eight inches in length. One-third of the incision lies above the umbilicus, the remainder below.

(2) The uterus is opened in the middle line by a longitudinal incision about six inches in length.

(3) The fœtus is rapidly extracted, and the cord is clamped and divided.

(4) The uterus is lifted out of the abdomen, and an assistant grasps the lower segment as far down as possible, and holds it tightly to prevent the occurrence of hæmorrhage.

(5) The placenta, membranes, and blood-clot, are removed from the uterus, and the cervix is ascertained to be patulous, or else it is dilated by pushing the fingers downwards through it.

(6) The uterine incision is sutured.

(7) The peritoneal cavity is cleansed from any blood, etc., that may have escaped into it, the uterus is replaced, and the omentum drawn into the most suitable position.

(8) The abdominal incision is sutured.

The operation is carried out as follows:—The patient is placed on an operating table, or if the operation is performed in a private house on a long and rigid table which is completely covered by sterilised sheets. After the preparation of the field of operation, the abdomen is opened in the usual manner in the middle line, by an incision eight inches in length. One-third of this incision lies above the umbilicus, and the remaining two-thirds below it. As soon as the peritoneum has been divided, the anterior surface of the uterus appears in the wound. As a rule, the uterine wall is incised while the uterus is still in the abdominal cavity, as its removal prior to emptying necessitates a longer abdominal incision. If, however, there is any reason to believe that intra-uterine decomposition has occurred, it is better to enlarge the incision and draw the uterus out before opening it, as thus the risk of peritoneal infection is lessened. If the uterus is incised *in situ*, care must be taken that it lies mesially in the abdomen and that there is no lateral rotation. This can be determined by noting the position of the tubal insertions, and, if there is any rotation, it must be corrected. An assistant holds the uterus in this position and at the same time keeps the abdominal wall firmly pressed against its sides, in order to prevent, so far as possible, the escape of liquor amnii into the peritoneal cavity. If the uterus is drawn out through the wound, it is padded round with gauze sponges with the same object.

Individual operators differ with regard to the best manner of making the uterine incision. It is usually recommended to make an incision of the full length at a single stroke, going down as close as possible to the chorion without cutting it. Kelly, on the other hand, recommends to make first a small incision, and divide the wall carefully and slowly down to the membranes. Then, to puncture the membranes, and, as the fluid is escaping, to introduce two fingers, and, lifting up the edge of the wall, to extend the incision as necessary. This is perhaps the better method. The most convenient site for the incision is in the middle line, but, if it is obvious that by making the incision there the placenta will be wounded, it is better to keep a little to one side, in order, even if we cannot get quite clear of the placenta, at all events to keep as near to the edge as possible.

The presence of the placenta in the line of the incision is always a source of additional trouble, as it increases the amount of maternal blood lost, and, if incision of the placenta is practised, the amount of fœtal blood also. There does not, however, appear to be any certain method of exactly determining the position of the placenta relative to the proposed site of incision. In some cases, the increased difficulty in palpating the fœtal parts through the anterior uterine wall, and the apparent increased thickness and vascularity of the uterine wall, may suggest its presence. Murdoch Cameron,* who has a large experience of Cæsarean sections, states that the fœtus always lies in the uterus in such a manner that its limbs correspond to the placental site. If the back of the fœtus is directed posteriorly, he considers that the placenta is usually attached to the anterior uterine wall, and, if the back is directed anteriorly, to the posterior uterine wall. The recognition of the site of the placenta is not, however, of very great practical value, as, even if the placenta is known to be directly in the line of incision, it is usually impossible to avoid it. Cameron recommends that in all cases, with the object of lessening the amount of blood lost, an oval vulcanite pessary should be pressed firmly against the uterine wall, so that a portion of the site of the incision falls within it, and this part of the wall then incised. This is a very easily adopted precaution, but it adds an unnecessary complication to the operation, and as the pessary must be removed in order to extend the incision, the amount of blood that is saved cannot be very great. If the placenta lies beneath the incision, the fingers should be quickly pushed between it and the uterine wall at whatever point is believed to be nearest to the placental edge, and the placenta rapidly detached until the edge is reached, when the membranes can be incised. If this cannot be done, the placental substance must be rapidly incised, or pierced with the hand, as in central placenta prævia (Cameron). In such cases, in order to avoid loss of fœtal blood, the cord should, if possible, be rapidly hooked out and compressed by the assistant while the fœtus is being extracted.

An innovation in the site of the uterine incision was suggested and practised by Fritz in 1897,† to the effect that the incision should be made transversely through the fundus, instead of longitudinally through the anterior wall. The advantage, which he considered such an incision offered, was diminished hæmorrhage, in that, as the vessels pursue a transverse course across the uterus, fewer of them would be divided. This mode of incision has been adopted by several operators with results that are very good, but still no better than those obtained in cases in which the more usual incision was made. The fundal incision is open to the objection that, for its adoption, the uterus must first be lifted out of the abdominal cavity, and that this necessitates a longer abdominal incision than would be otherwise necessary. Also, as Williams points out, if the uterine cavity subsequently becomes infected, there is more risk of the infection extending to the peritoneal cavity through a fundal incision which is in direct contact with the intestines, than there is in the case of an anterior incision which can become adherent to the abdominal wall.

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* 'Text-book of Gynæcology,' edited by C. L. Reed, M.D., 1901, p. 465.

† 'Ein neuer Schnitt bei der Sectio Cæsarea,' *Centralbl. f. Gyn.*, 1897, pp. 561-565.

As soon as the uterine incision has been completed, the next step is the extraction of the fœtus. Two methods of doing this are respectively advised by different operators. One consists in passing the hand quickly down to the lower part of the uterus and scooping out the head, the remainder of the fœtus following. The other consists in seizing the fœtus by the feet, and extracting it by traction upon them. The advantage of the first method is that it avoids the risk of the edges of the uterine incision contracting round the neck of the fœtus. If the membranes are unruptured, head extraction is possible, but, if the membranes have been long ruptured, it is difficult, as it practically necessitates the performance of internal version. In such cases, leg extraction is necessary, and, to avoid any delay through the catching of the chin in the edges of the wound, the head as it emerges may be kept in a position of flexion by passing the fingers into the mouth.

If the head has become impacted in the pelvic brim, there may be some difficulty in its extraction. In such cases, the legs, which have been drawn out through the incision, are seized in one hand, while the other hand, passed down into the bottom of the uterus, seizes the fœtus by the neck and shoulders. At the same time, with one finger the head is kept in a position of flexion either by traction on the jaw or by pressure on the occiput, according as the position of the fœtus makes one or other manipulation the easier. The head is then drawn upwards, keeping it at first in the axis of the pelvic brim. If this course is not successful in freeing the head, an assistant should pass his fingers into the vagina and push up the head as quickly as possible. The essentials in the delivery of the fœtus are rapidity and gentleness. If there is any delay it may cost the life of the infant, especially in cases in which the placenta has been wounded, and, if undue force is used, laceration of the uterus may result. As soon as the infant is extracted, the cord is clamped and divided, and the infant is handed over to the care of the assistant whose duty it is to attend to it. 4 The uterus is then drawn out through the abdominal wound.

As a rule, as soon as the fœtus has been extracted, the uterus contracts and checks all hæmorrhage. If contractions do not immediately occur, and there is much bleeding either from the incision or the wounded placental site, the assistant firmly grasps the uterus round its lower segment with both hands, and thus compresses the vessels. The use of a temporary elastic ligature round the lower segment of the uterus was recommended by Litzmann as a prophylactic measure against hæmorrhage. It is, however, an unnecessary precaution, and is also said to interfere with the subsequent contraction of the uterus.

5 As soon as the uterus has been drawn out of the abdomen, a large and flat gauze sponge, wrung out of hot water, is placed above and behind it, in such a manner as to prevent the escape of the intestines, and, if necessary, the edges of the abdominal wound may also be brought together above the uterus by an American forceps. If the placenta has been detached, it is drawn carefully out of the uterus, taking care to bring all the membranes with it. If it is still adherent, it is separated with the fingers in the usual manner. Care must be taken that large pieces of membrane are not left behind, but it is quite unnecessary to spend time in scraping away all small fragments of decidua. If the uterus does not contract properly, contractions may be stimulated by covering the whole organ with sponges wrung out of very hot water, and then compressing and kneading it through the sponges. As a rule, however, contraction is immediate and sufficient once the uterus is emptied.

6 The next step is the suture of the uterine incision. The usual suture material is fine silk. Catgut is objectionable, as it may be absorbed too soon. The sutures are passed as interrupted sutures, from above downwards. They are entered about half a centimetre from the edge of the incision, and traverse the entire thickness of the uterine wall with the exception of the mucosa. They are inserted about a centimetre apart, and, after each suture is passed, the suture two behind it is tied. This checks all bleeding in the neighbourhood of the tied suture, and, at the same time, does not bring the edges of the unsutured portion of the wound so closely together as to make the insertion of the remaining sutures difficult. As soon as all the deep sutures have been inserted and tied, a further row of superficial sutures, including the peritoneum and a small piece of the muscle, are inserted between them in order to bring the peritoneal edges exactly together. Any hæmorrhage from the needle holes can be checked by exerting for a few moments firm pressure on the bleeding-point with a sponge wrung out of hot water. The method of suturing recommended by Sänger, in which small flaps of peritoneum were made along each edge of the wound, in order that by bringing these flaps together a sero-serous union might be obtained over

the incision, is unnecessary, and has been generally abandoned. It takes a considerable amount of additional time to form the flaps, and it is not improbable that the presence of sero-serous instead of muscular union along a portion of the thickness of the wound may lead to a weaker cicatrix than would otherwise be the case.

7 As soon as the uterine suture is complete and all hæmorrhage from the incision has ceased, the peritoneal cavity is cleansed, all clots, etc., being carefully removed, and the uterus is returned. Kelly recommends that instead of following the usual course and drawing down the omentum beneath the abdominal incision, it should be drawn down behind the uterus in such a manner as to shut off the intestines from the uterine incision. This has the advantage of isolating the intestines in cases in which subsequent infection of the wound area occurs, but it has the disadvantage that it increases the likelihood of adhesions forming between the uterus and the abdominal wall, and as the uterus involutes and shrinks back into the pelvis, these may give rise to distortion of the organ. It is a prudent precaution to adopt in cases in which, owing to the previous course of labour, there is any reason to think that infection is likely to occur, but, if we believe that perfect asepsis has been maintained, we prefer the more usual plan of drawing down the omentum beneath the abdominal incision.

8 The final step of the operation is the suture of the abdominal wound. In all cases of cœliotomy we prefer Kelly's method of suturing, using catgut for the peritoneum and silk-worm gut for the fascia and the superficial sutures. The abdominal wound is dressed in the usual manner with a dry sterilised dressing, which is kept in place with strips of strapping and an abdominal binder.

In some cases, it is advisable to prevent the occurrence of future pregnancies on account of the danger attached to them. As the removal of the ovaries is an undesirable expedient, and one on which unpleasant after-effects are consequent, the usual method consists in interrupting the passage through the Fallopian tubes. The older methods of applying a single ligature round each tube, or even a double ligature and excising the included portion, have been proved to be insufficient, as the ligatures become absorbed and the tubal lumen restored. The most reliable method is that recommended by Whitridge Williams, which consists in ligaturing and dividing the uterine ends of the tubes, then excising the interstitial portion traversing the uterine wall, and finally bringing the edges of the resultant gap together with sutures.

Radical Cæsarean Section. — The operation of radical Cæsarean section consists in the removal of the fœtus from the uterus in the manner just described, followed by the removal of the uterus either supravaginally or completely. Under this heading three operations must be discussed:—

(*a*) The classical Porro-Cæsarean operation.
(*b*) Partial hysterectomy.
(*c*) Complete hysterectomy.

The Classical Porro-Cæsarean Operation.—The classical Porro-Cæsarean operation consists in the removal of the fœtus through an incision in the anterior uterine wall, as in the conservative operation; the arrest of hæmorrhage by the application of the noose of a serre-nœud round the upper part of the cervico-uterine junction; the amputation of the body of the uterus above the noose; and the fixation of the stump thus left in the lower angle of the abdominal wound. This operation is now practically never performed, for the reasons mentioned at the commencement of this chapter. It possesses one advantage, namely, that it is slightly more rapid than any other method of dealing with the uterus after the removal of the fœtus, and consequently it may be of value in cases in which the patient is much exhausted by previous hæmorrhage. We do not consider it necessary to describe the operation at any length, and shall enumerate only its successive steps. These are as follows:—

(1 - 3) These steps are identical with the first three steps of the conservative operation.

(4) The broad ligaments are tied on each side between the ovaries and the uterus, or outside the ovaries if it is desired to remove the latter, and divided. The bladder is pushed down off the anterior face of the uterus.

(5) The wire noose of a serre-nœud—an instrument resembling an écraseur—is passed over the uterus and pushed downwards until it comes to lie over the lower zone of the latter The noose is then tightened until it firmly compresses the tissues included in its grasp.

(6) The body of the uterus is then cut away, about an inch above the noose. If there is any further hæmorrhage, the noose is tightened.

(7) Two specially made pins, with guarded ends, are then passed transversely through the stump just above the wire. These pins lie on the abdominal wall, and support the stump in such a manner that the noose is outside the peritoneum.

(8) The abdominal wound is closed, care being taken to unite the peritoneum carefully round the stump.

Partial Hysterectomy with Retro-Peritoneal Treatment of the Stump.—In this operation the uterus is removed supravaginally, and the pelvic peritoneum brought together over the stump in such a manner as to place the latter outside the peritoneal cavity. As performed in the case of the pregnant uterus, it differs little from the operation performed in the case of a large myomatous uterus, and, consequently, it is only necessary to enumerate its successive steps, as full descriptions of the operation will be found in works on gynæcology. It is the modern counterpart of Porro's operation, and is adopted in all cases in which it is impossible or inadvisable to allow the uterus to remain, and in which complete hysterectomy is not indicated. The different steps are as follows:—

(1-3) These steps are identical with the first three steps of the conservative operation.

(4) Ligation of the ovarian vessels and the round ligament on each side, keeping either inside or outside the ovaries according as we desire to leave or to remove the latter.

(5) Detachment of the vesico-uterine fold of peritoneum from side to side and pushing it well down so as to completely strip the bladder off the uterus.

(6) Similar detachment of a flap of peritoneum off the posterior surface of the uterus.

(7) Ligation of the uterine vessels on each side.

(8) Amputation of the uterus just above the vaginal insertion.

(9) Coaptation by suture of the divided edges of the cervix, and control of all bleeding vessels.

(10) Suture of the flap of peritoneum which was stripped off the anterior uterine wall to the posterior flap.

(11) Closure of the abdominal wound.

Complete Hysterectomy.—Complete hysterectomy only differs from the operation just described in that, instead of amputating the uterine body, an opening is made into the posterior vaginal vault through the floor of Douglas' pouch, the vaginal walls are divided all round with scissors, and the entire uterus and cervix thus set free are removed. It is an operation which is rarely required, and which is rendered comparatively easy by the fact that the laxity of the pelvic floor allows the uterus to be drawn almost completely out of the peritoneal cavity, and so permits more easy access to the vaginal insertion of the cervix than in the case of a myomatous uterus.

After-treatment.—The after-treatment of Cæsarean section is identical with the after-treatment of abdominal cœliotomy for any other purpose. The abdominal sutures are removed on the eighth day, and the patient may be allowed out of bed about the fourteenth to the twenty-first day provided convalescence has proceeded normally. No special treatment, such as vaginal or uterine douching, is indicated so long as the lochia remain healthy.

Prognosis.—Since the introduction of the Sänger operation, the prognosis of Cæsarean section has steadily improved *pari passu* with improvements in the technique of abdominal surgery and the introduction of asepsis. Williams records the results of 335 collected cases in which the conservative operation was performed in different Continental and American clinics. Out of this number, twenty-three women died, a percentage of 6·87, and this percentage can be further reduced to 4·06 if the patients who were infected prior to the performance of the operation are excluded. The mortality after the radical operation is naturally higher as a result of the complication which necessitated the removal of the uterus. The chief cause of a high rate of mortality after Cæsarean section, next to want of asepsis, is hesitation. The nervous operator who desires to give the patient every chance of delivering herself, or who makes every effort to deliver her *per vias naturales*, in spite of the fact that his judgment tells him that such a course is impossible, will have a very high death-rate, for the obvious reason that many of his patients are infected before the operation, while others are too exhausted to stand the shock of the operation. The more frequently an operator has to perform the operation, the lower will be the mortality, not alone because he has acquired special skill, but because he will not hesitate to operate early in labour on the cases that require operation. Once it is recognised that delivery of a living child *per vias naturales* is impossible, and it is determined to perform Cæsarean section, no further vaginal examinations or manipulations, other than a single vaginal douche, should be allowed. The essentials for good results are asepsis, early operation, and rapidity from the commencement of the uterine incision to the tying of the uterine sutures. After that, the completion of the operation may be performed with deliberation, and sufficient time spent to ensure perfect hæmostasis and coaptation of the abdominal wound.

SYMPHYSIOTOMY

Symphysiotomy is the term applied to the division of the ligaments of the symphysis pubis with the object of permitting the innominate bones to separate, and so of enlarging the diameters of the pelvis.

The operation of symphysiotomy is said to have been performed for the first time by De la Courrue[*] in 1654, but it was not until its revival *de novo* by Sigault in 1768 that it can be considered to have been brought to the notice of medical men. Hull[†] gives an interesting account of its reception:—'No discovery in the healing art was ever announced with so much *éclat.* It was proposed by M. Sigault in the year 1768, to the Royal Academy of Surgery at Paris. But the report of M. Ruffel, who was appointed to inquire into the merits of the operation, being unfavourable, it did not receive the countenance or sanction of that respectable body. Notwithstanding this discouragement to his project, M. Sigault determined to put it in execution, as soon as a favourable opportunity should occur, and it was first practised by this physician, with the assistance of M. le Roy, in Paris, on the first of October, 1777, upon the wife of a soldier named Souchot, who, out of four children, had not been able to bring one into the world alive. Although the urethra was wounded in the operation, the vesica urinaria materially injured, and the poor woman's life greatly endangered, the Faculty of Medicine at Paris, on the report of Granclas and Descemet (two of their members, who had been deputed to attend to the case) and a view of the woman, without waiting for further experience, immediately caused a medal to be struck in honour of the inventor; and the French Government rewarded both the operator and his patient with a pension. . . . The operation was supposed to be capable of superseding not only the Cæsarean operation and the crotchet, but even the use of the forceps, and every obstetrical instrument whatever.' Hull, who was a strong opponent of the operation, was able to collect the results of forty-four cases of symphysiotomy performed between 1777 and 1800, of which thirty women survived and fourteen died. Fifteen children were saved, while twenty-two were born dead or died immediately after birth. Subsequent to 1800, the operation appears to have been practically abandoned, 'being,' as Hull says, 'no longer recommended by any practitioner, who has seen it performed, and attended to its consequences.'

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[*] *Vide* Siebold, E. C. J.: 'Abbildungen aus der Geburtshülfe,' Berlin, 1829, S. 238.

[†] *Op. cit.*, p. 92.

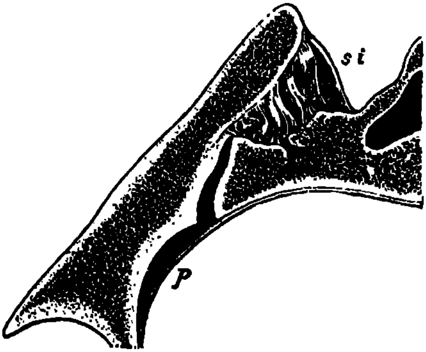

Fig. 440.—Horizontal Section through the Right Sacro-iliac Joint of a Pelvis on which Symphysiotomy has been performed.

si, Relaxed sacro-iliac ligaments; *p*, periosteum, which has detached as the pelvic bones separated. (Farabœuf.)

The operation was revived in 1866 by Morisani of Naples, and this operator was able to report to the International Medical Congress,* in 1881, fifty operations with forty recoveries. Since that time, its former history has been repeated, and it has been the subject of condemnation and approval. At the present time, its position is fairly generally recognised, its indications and limitations made clear, and, on the whole, in spite of many opponents, it may be said to hold the place to which it is entitled, as an operation which at times is of considerable value.

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* 'De la symphyséotomie,' *Annales de Gyn. et d'Obst.*, 1881, xvi., 444, 445.

Effect of Symphysiotomy on the Pelvis.—The result of division of the inter-pubic ligaments is that the pubic bones spring apart under the influence of the pull of the posterior sacro-iliac ligaments upon the posterior limb of the iliac lever. Two results follow from this. All the diameters of the pelvic brim are increased in length, and a gap occurs between the ends of the pubic bones, into which gap a part of the circumference of the head is able to bulge. Thus, not only is the size of the pelvis directly increased by the lengthening of its diameters, but it is indirectly increased by the occurrence of this gap. The extent of the increase, which takes place in the diameters, depends on the extent to which the pubic bones are separated, and the initial size of the pelvis, and of these the former is the more important factor. The average amount of separation of the bones is about 6 cms., and this yields an average increase in the true conjugate of 1·5 cms. ($\frac{3}{5}$ in.). The greatest amount that has been obtained without causing injury to the sacro-iliac articulations is 9 cms., yielding an increase in the true conjugate of a little over 2 cms. ($\frac{4}{5}$ in.). The limit of separation which is permissible, and which should not be exceeded, is, however,

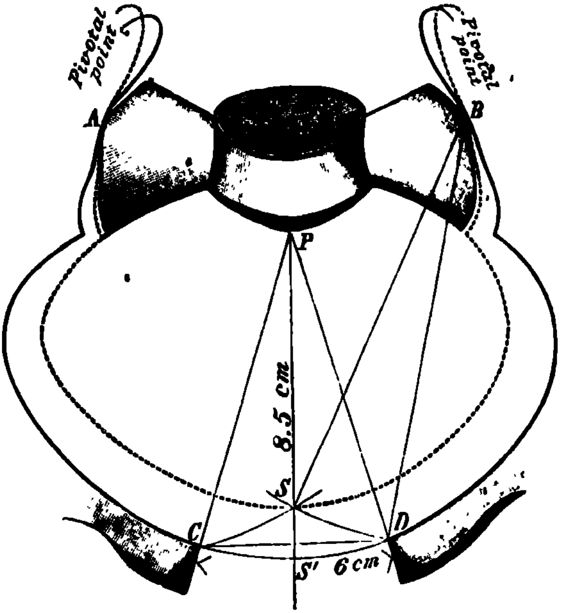

FIG. 441.—DIAGRAM OF PELVIC BRIM SHOWING THE GAIN IN SPACE ON OPENING THE SYMPHYSIS.

PS, Conjugate of brim when the pelvis is closed. *PS'*, conjugate, after symphysiotomy has been performed, bones 6 cms. apart. (Wehle.)

usually stated to be 7 cms. The effect of the initial size of the pelvis on the increase produced in the diameters by a given degree of separation of the bones is in inverse proportion to the initial size. The larger the pelvis, the less is the increase in the diameters; the smaller the pelvis, the greater is the increase. The indirect increase produced by the gap between the bones is estimated by Morisani to be one centimetre in cases in which the separation of the bones is 6·5 cms., and in which one parietal eminence bulges into the gap.

A further cause of increase in the diameters must be mentioned—namely, the effect of the downward movement of the pubic bones as they separate. This movement is identical with that which occurs when the patient is placed in Walcher's position. According to Sandstein, Walcher's position causes an average descent of the pubic bones at the symphysis of 5 mm., and symphysiotomy with 6 cms. separation of the bones an average descent of 8·4 mms.

The following table was drawn up by Farabœuf to show the combined effects of the foregoing factors on pelves of different sizes, in which different degrees of separation of the pubic bones had been obtained: –

Interval between the Bones.	Increase in the C.V. in the case of a Pelvis measuring originally in that Diameter					
	5 cms.	6 cms.	7 cms.	8 cms.	9 cms.	10 cms.
5 cms. - -	23 mms.	21 mms.	19 mms.	17 mms.	16 mms.	14 mms.
6 ,, - -	29 ,,	26 ,,	23 ,,	21 ,,	19 ,,	18 ,,
7 ,, - -	34 ,,	31 ,,	28 ,,	25 ,,	23 ,,	21 ,,

It must not be thought that the antero-posterior pelvic diameters alone are affected by symphysiotomy, as all the other diameters are similarly affected even to a greater extent. Thus, the increase in the oblique diameters is once and a half as much as is that in the conjugate, and in the transverse about twice as much.

Perhaps the following statement made by Farabœuf* will give a more immediately obvious impression of the alteration in the size of the pelvis produced by symphysiotomy than will the foregoing figures:—A pelvis, having a minimum sacro-pubic measurement of 8 cms. (3⅛ ins.), in which the symphysis is divided and the bones separated to the extent of 6 cms. (2⅜ ins.), will allow a sphere of 9·8 cms. (4 ins. approximately, equal to a very large fœtal head) to pass through, whilst when intact it would only admit a sphere of 8 cms. diameter (a small fœtal head) (*v.* Fig. 442). The benefit derived from the operation will be the more appreciated when we recollect that the capacity of the first sphere is almost double that of the second. In other words, a fœtus of 3,000 grms. (6 lbs. 10 ozs.) is smaller in relation to a divided pelvis than is a fœtus of 2,000 grms. (4 lbs. 6 ozs.) to the same pelvis prior to division. Again, take the case of a pelvis with a sacro-pubic diameter of 6 cms. instead of 8 cms., and with a similar pubic separation of 6 cms. In such a case, the diameter of the sphere admitted after symphysiotomy will be 8·4 cms., while prior to section it was 6 cms., and in capacity the first sphere will be almost treble the second.

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* 'La Symphyséotomie, Anatomie, Instrumentation et Technique du Professeur Farabœuf,' by P. A. Lop, *Gazette des Hôp.*, 1895, Nos. 47, 50, 53. Also 'Précis de Médecin Opératoire,' 4th edition, 1895.

Indications.—The principal indication for the performance of symphysiotomy is a certain degree of pelvic contraction. According to Morisani, the minimum antero-posterior diameter in which symphysiotomy is permissible is 7 cms. (2⅘ ins.). This figure is based on the assumption that the average amount of permissible separation of the bones gives an increase in the conjugate of 1·5 cms. (⅗ ins.), and that, by the protrusion of one parietal eminence into the gap, a further increase of a centimetre is obtained. If the average length of the bi-parietal diameter of the head is taken to be 9·5 cms. (3⅘ ins.), it will be seen that such a head will just fit into a pelvis with an original conjugate of 7 cms., enlarged by the addition of 2·5 cms.

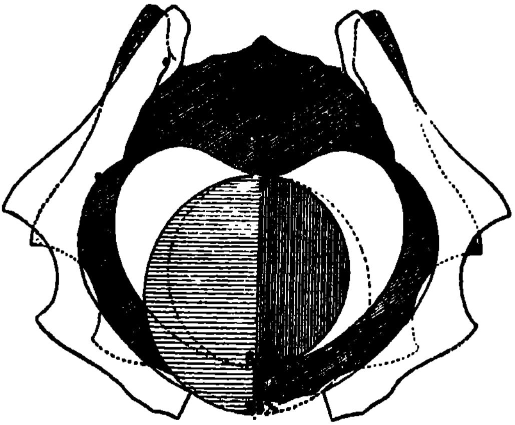

FIG. 442.—DIAGRAM SHOWING THE MANNER IN WHICH THE HEAD BULGES BETWEEN THE SEPARATED PUBIC BONES, AND THE RELATIVE SIZES OF THE SPHERES WHICH WILL PASS THROUGH BEFORE AND AFTER SYMPHYSIOTOMY. (Farabœuf.)

If the operation is permissible in cases in which the obstruction is due to pelvic contraction, it follows that it is also permissible in cases in which the obstruction is due to excessive size of the otherwise normally developed head, or in cases in which the head has become impacted in a malpresentation, which cannot be corrected, and cannot be delivered by the forceps. We are not, however, aware that the operation has been performed under such circumstances, a fact which is probably due to the difficulty of recognising that delivery is impossible until labour has been so long in progress that the death of the fœtus has occurred.

So far as contracted pelvis is concerned, we thus see that symphysiotomy is an alternative in the higher degrees of pelvic contraction to Cæsarean section, in the lower degrees to premature labour and version. The induction of premature labour can scarcely be regarded as an alternative. It is, in our opinion, the correct treatment to adopt if the case is seen in time; but, even if it is adopted, the advisability of symphysiotomy may still become a matter for discussion in cases in which the head does not pass through the brim, though, if a correct estimate is made of the relative sizes of the fœtal head and the pelvis, such cases will not occur. If the patient is not seen in time, the induction of premature labour is, necessarily, not a possible mode of treatment. Prophylactic version and symphysiotomy, on the other hand, are directly competing lines of treatment, for, if the former is adopted and fails, it is too late to perform the latter. We have already referred to the relative position of the two procedures when discussing the treatment of contracted pelvis.* Prophylactic version is contra-indicated in general contraction, and symphysiotomy or Cæsarean section is preferable. In flattened pelvis, much depends on the individual operator, but, if prophylactic version has failed to procure a living child in former labours, some alternative method should be tried, and here again a choice must be made between the operations just named. Cæsarean section is a simpler operation, and can be more safely performed by a comparatively unskilled operator. It requires fewer assistants, and convalescence is more rapid. For these

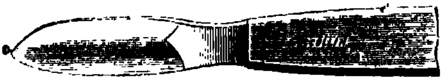

FIG. 443.—FARABŒUF'S KNIFE FOR DIVIDING THE SYMPHYSIS PUBIS.

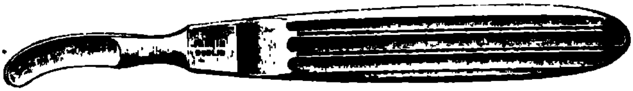

FIG. 444.—GALBIATI'S SICKLE-SHAPED KNIFE FOR DIVIDING THE SYMPHYSIS PUBIS.

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* *Vide* Part VII., Chap. II., p. 730.

reasons we believe that it will always be the more popular operation, though under certain circumstances, especially in hospital practice, symphysiotomy may be preferable. One very great advantage, which the latter operation has over Cæsarean section, is that it may cause a permanent increase in size in the pelvis, even in cases in which recovery is perfect. We have seen a patient at the Rotunda Hospital, on whom Smyly had performed symphysiotomy in a previous pregnancy owing to other means having already failed to obtain a living child, deliver herself of a living infant. Cæsarean section, on the other hand, owing to the possible weakening of the uterine wall in the neighbourhood of the incision, always leaves the patient in a slightly more unfavourable state, so far as future pregnancies are concerned, than she was before the operation was performed.

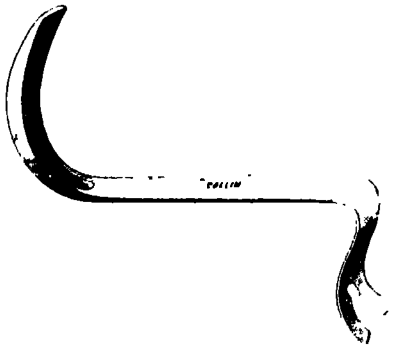

FIG. 445.—FARABŒUF'S GROOVED SOUND FOR PROTECTING THE TISSUES BEHIND THE SYMPHYSIS DURING SECTION OF THE JOINT.

There are certain cases in which, in our opinion, symphysiotomy is definitely indicated and in which there is no alternative treatment if the life of the fœtus is to be saved, namely, in those cases in which labour has been in progress for a considerable time, the forceps have failed to effect delivery, and the fœtus is alive. Under such circumstances, Cæsarean section is contraindicated, and craniotomy is the only alternative.

Instruments.—The following instruments are required:—Two scalpels, two pairs of scissors, two lateral retractors for the edges of the incision, stout whole-curved needles of different sizes, needle-holder, a dozen clip forceps, several straight and curved narrow-bladed clamps, metal catheter, dissecting forceps with teeth, suture materials, iodoform gauze, and the usual gauze sponges and dressings. In addition to this list, the following instruments are an assistance, though they are not indispensable:—A special knife for dividing the symphysis, either sickle-shaped as recommended by Galbiati, or Farabœuf's knife—a bistoury with a short strong blade, thinner at the edges than in the middle; Farabœuf's grooved sound; and some form of registering separator for the pubic bones, such as Pinard's.

Assistants.—Four assistants are essential. One assistant sits at each side of the patient to help the operator, and to prevent the innominate bones from springing apart with undue suddenness; one manages the instruments, sponges, and sutures; and one administers the anæsthetic.

Operation.—The patient is placed on an operating table in the lithotomy position, the pubes is shaved, and the external skin and the vagina washed and disinfected in the usual manner. If the os is not dilated sufficiently to allow the passage of the fœtus, dilatation must be effected beforehand by means of hydrostatic or other dilators.

The steps of the operation are as follows :—

(1) An incision is made through the skin and subjacent tissues, starting an inch and a half above the symphysis and extending downwards to a point just above the clitoris.

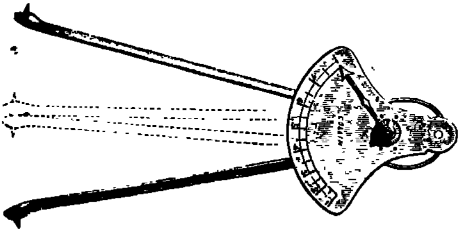

FIG. 446.—PINARD'S SEPARATOR FOR MEASURING THE DISTANCE BETWEEN THE PUBIC BONES AFTER SYMPHYSIOTOMY.

(2) The suspensory ligament of the clitoris is divided, and the clitoris is drawn downwards so as to expose the outline of the pubic arch.

(3) A vertical incision of sufficient size to admit the finger is made through the aponeurosis of the recti. If necessary, this incision is increased in length by dividing the aponeurosis transversely on each side of the vertical incision.

(4) The finger is introduced into this opening, and pushed downwards behind the symphysis until it appears beneath the latter, and in such a manner as to detach the retro-pubic structures from the symphysis. This detachment is also carried out laterally for an inch to two inches at each side of the symphysis. A catheter is introduced into the urethra, and the latter pushed backwards and to one side.

(5) The pubic ligaments are cautiously divided from behind and above downwards and forwards, the assistants at the same time making pressure on the sides of the pelvis to prevent the innominate bones from springing apart suddenly.

(6) The instrument for measuring the degree of separation of the bones is introduced between the bones, and the latter are allowed to separate gradually as the assistants relax their pressure on the sides of the pelvis. If a sufficient degree of separation does not occur spontaneously, the thighs are cautiously separated, if necessary with a slight degree of force, until the register shows that the necessary degree of separation has been obtained. This should not exceed 6 cms.

(7) The child is extracted by the forceps, or, after version, by traction on the leg if the pelvic pole presents.

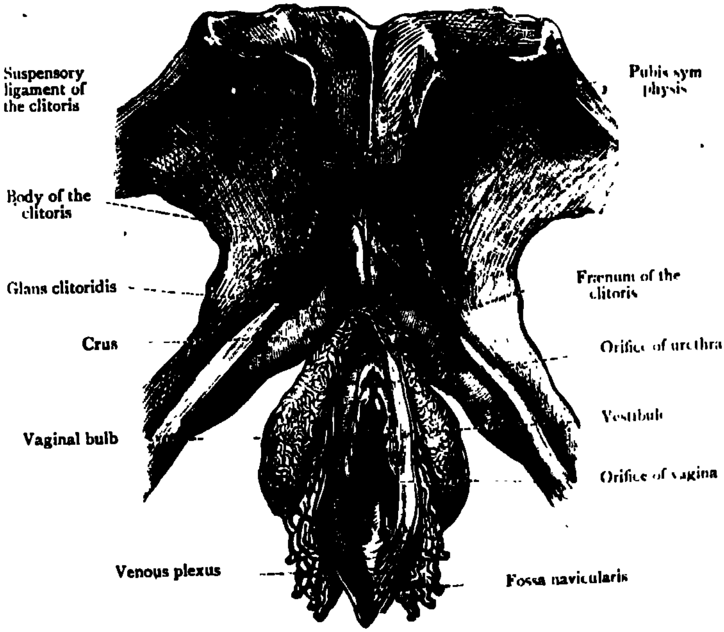

FIG. 447.—THE SYMPHYSIS PUBIS SEEN FROM IN FRONT, SHOWING THE RELATIONS OF THE CRURA OF THE CLITORIS.

(From Toldt's 'Anatomy,' by permission of Messrs. Rebman.)

(8) A gauze sponge is placed behind the separated bones to push back the retro-pubic structures and prevent them from being nipped between the bones, and deep sutures of strong silk traversing the whole thickness of the incision down to and including the periosteum are inserted. A couple of suture points of silkworm gut are also inserted to bring together the edges of the divided aponeurosis. The assistants then press together the pelvic bones, until the edges of the pubic bones come together, care being taken that nothing intervenes between them. The

sutures in the aponeurosis are tied and cut short, and then the silk sutures are tied. If necessary, a few superficial sutures are inserted to bring the skin edges perfectly together, the gauze sponge behind the symphysis having been first removed.

(9) The wound is dressed with a dry dressing, and a many-tailed binder is applied firmly round the pelvis in such a manner as to afford the necessary support to the bones. Finally, over all, the ordinary abdominal binder is tightly applied.

In making the separation of the retro-pubic tissues, care must be taken to keep close to the bone, in order to avoid as far as possible tearing the veins. If, after division of the cartilage of the joint, the bones do not separate, it is usually due to the fact that some fibres of the sub-pubic ligament have been left undivided. The exact position of the symphysis can as a rule be ascertained by palpating the joint with the finger, but if there is any difficulty in doing so, its position can be easily determined by gently pricking the surface of the bones with the point of the knife, until the lessened resistance shows that the knife is cutting not bone but cartilage. As the bones separate, the finger should be kept in relation to the attachments of the crura of the clitoris to the descending rami of the pubes, and if the crura become so tense that rupture appears probable, they must be further separated from the bones. Forcible separation must always be carried out with extreme caution, and, while it is made, its effect as shown by the register must be carefully watched. Similarly, as the head of the infant is being extracted, and is forcing the innominate bones still further apart, the assistants must apply lateral counter-pressure in order to prevent too great separation. For the same reason, traction must be made slowly and with caution, indeed, some operators, and notably Zweifel, advise to leave delivery to the natural efforts, as such delivery is more gradual than if effected by the forceps. Such a course, however, possesses the disadvantage that it causes delay, and consequently is not always practicable.

From three to four deep sutures are usually necessary, and as there is a considerable amount of strain upon them, it is advisable to tie them over lead plates in order to prevent them from cutting through the skin. Zweifel recommends that a drainage tube be always placed in the gap left behind the pubes, in order to prevent an accumulation of blood which might be subsequently infected. If a considerable space is left behind the bones this precaution is advisable, but, if the tissues come well together and there is not much hæmorrhage or oozing, we doubt if it is necessary. If it is, we prefer the use of a drain of iodoform gauze instead of a tube. In applying the dressings over the incisions, care must be taken to keep them quite separate from the vaginal dressings, as the latter require to be changed frequently.

After-treatment.—The after-treatment and the nursing of the patient is difficult and tedious, and constitutes one of the great objections to the operation. The patient must be kept at rest on her back, on a firm bed, for three to four weeks, during which time the pubic bones are kept together by a tight binder. At the same time, the usual nursing details of the puerperium must be attended to, with the addition that the catheter must be passed regularly. When the time comes to allow the patient out of bed, a properly fitting pelvic belt should be provided, and be worn continuously for the twelve months after the operation.

Prognosis.—The prognosis of symphysiotomy, when performed by competent operators, is on the whole good. In 278 cases collected by Neugebauer, there was a maternal mortality of 11·1 per cent., but this percentage has been considerably reduced by others. Bar records 140 cases operated upon by Pinard, Zweifel, and Küstner with a mortality of 6·7 per cent., while Zweifel has operated upon 31 cases without a death. The principal dangers of the operation are rupture of the bladder or urethra during the separation of the bones; hæmorrhage from the plexus of veins behind the symphysis, or from laceration of the clitoris; rupture of the sacro-iliac articulations; failure to obtain union between the pubic bones; and septic infection. Such accidents occasionally occur even in the hands of experienced operators, and, if the operation was to be adopted by the general practitioner, as has been suggested, they would necessarily be of far more frequent occurrence. We do not agree with the opinion expressed by Whitridge Williams that the present enthusiasm for symphysiotomy will eventually disappear, if by this he means that the operation will cease to be performed, but we consider that it is essentially an operation to be performed by the skilled specialist, amidst the favourable surroundings of a hospital.

CHAPTER V

CRANIOTOMY AND EMBRYOTOMY

Craniotomy—Instruments—Steps of the Operation; Perforation, Evacuation, Compression, Extraction. Embryotomy—Decapitation—Evisceration—Cleidotomy.

CRANIOTOMY

CRANIOTOMY is the term applied to any cutting or crushing operation on the head of the fœtus performed prior to delivery with the object of reducing its size.

Indications.—The operation of craniotomy of necessity involves the death of the fœtus, if this has not already occurred, and consequently it should never be performed in the case of a living infant unless no other means of effecting delivery can be carried out, under the circumstances of the case. It is the duty of the obstetrician to reduce the number of such cases to the lowest limit, and in recent years, in consequence of the improvements which have taken place in the technique of Cæsarean section and symphysiotomy, great advances have been made in this direction. The operation cannot be performed unless the size of the genital canal is sufficient to allow the passage of the fœtus after reduction in size. It is, in consequence, contra-indicated in all cases in which there is absolute pelvic contraction, that is, contraction in which the conjugate measures less than 2¼ inches in the case of a flat pelvis, or than 2½ inches in the case of a generally contracted pelvis. It is true that a mutilated fœtus has been extracted through a pelvis even smaller than this, but the dangers associated with such an operation are greater than those associated with Cæsarean section. The performance of craniotomy is also inadvisable or impossible in the case of pelves markedly deformed by the presence of tumours, or when the vagina is rendered undilatable owing to the presence of old cicatrices. We thus see that the operation is one which possesses only a limited range of applicability. It is unnecessary when there is only slight disproportion between the pelvis and the fœtus. It is never the operation of choice in the presence of a living fœtus. 3 It is impossible when the disproportion between the size of the fœtus and the pelvis exceeds certain limits.

Craniotomy is indicated under the following conditions:—

(1) It is absolutely indicated if the fœtus is dead, and if the extraction of the undiminished head is either dangerous or impossible.

(2) It is relatively indicated if there is a relative indication present for the performance of Cæsarean section or symphysiotomy, but the patient refuses to allow such an operation.

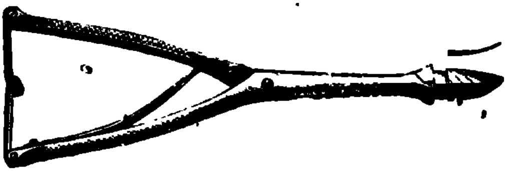

FIG. 448.—SIMPSON'S PERFORATOR.

Instruments.—The following special instruments are required for craniotomy:—An instrument for perforating the head, such as Simpson's perforator, or Smellie's scissors. An instrument for washing out the brain from the perforated head, such as a large-sized Bozemann's catheter. An instrument for crushing and extracting the perforated head, such as a cranioclast, a cephalotribe, Winter's modification of Auvard's combined cranioclast and cephalotribe, or Simpson's basilyst. Personally, we consider that the two instruments most suitable for perforation, crushing and extraction are Simpson's perforator and Winter's modification of Auvard's combined instrument, but each individual operator will be largely guided by his own past experience

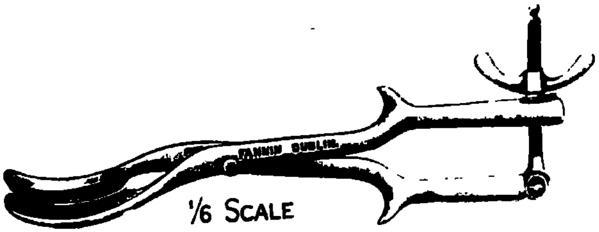

FIG. 449.—BRAUN'S CRANIOCLAST.

or by the experience of his teachers. Simpson's perforator possesses the advantage over Smellie's scissors that it can be used by the operator without assistance, while the scissors requires three hands to work it,—one hand to hold it in position outside the vulva, one hand to keep it in position against the head of the fœtus, and a third hand to help the first hand to separate the blades.

All forms of crushing and extraction instruments are more or less based on the cranioclast and the cephalotribe. The cranioclast is a two-bladed instrument, with concavo-convex blades so adapted to one another that their curves correspond (*v.* Fig. 449). One blade is applied inside the skull, the other blade outside. In consequence, it is admirably adapted for seizing and pulling upon the head without slipping. It causes an elongation in the shape of the head, and consequently a compensatory diminution in the other diameters, as shown in Fig. 450. It is, however, obviously unsuited for producing a marked diminution in the base of the skull, as it only compresses one lateral wall, and not the entire base. The cephalotribe is also two-bladed, with concavo-convex blades, but they are so adapted that the curves are opposed to one another, as in the case of the forceps, and both blades are applied outside the head (*v.* Fig. 451, B). Consequently, it is well suited for crushing the base of the skull, as it includes the entire base between its blades. It is, however, a bad extractor, as it tends to slip. To compress sufficiently, the curve of its blades must be slight, otherwise there would be too much space between them. To extract without slipping, the curve must be so pronounced that it grips the head as does a forceps.

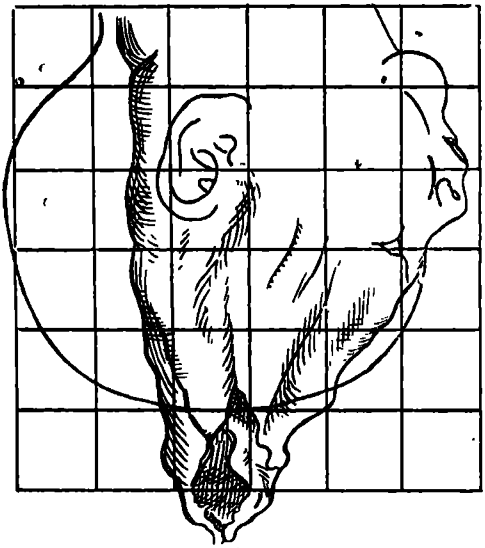

FIG. 450.—DIAGRAM SHOWING THE EFFECT OF TRACTION WITH A CRANIOCLAST ON A PERFORATED HEAD.

As both the cranioclast and the cephalotribe thus possess complementary qualities, it is not strange that many attempts have been made to produce a satisfactory combination of them.

Auvard's combined instrument is, as its name shows, practically the two instruments in one. Two blades form a cranioclast with which the head is seized and held firmly, the third blade forms a cephalotribe in conjunction with the other two. As modified by Winter, it is the instrument of which we have the most experience, and we consider that it is admirably suited to its purpose.

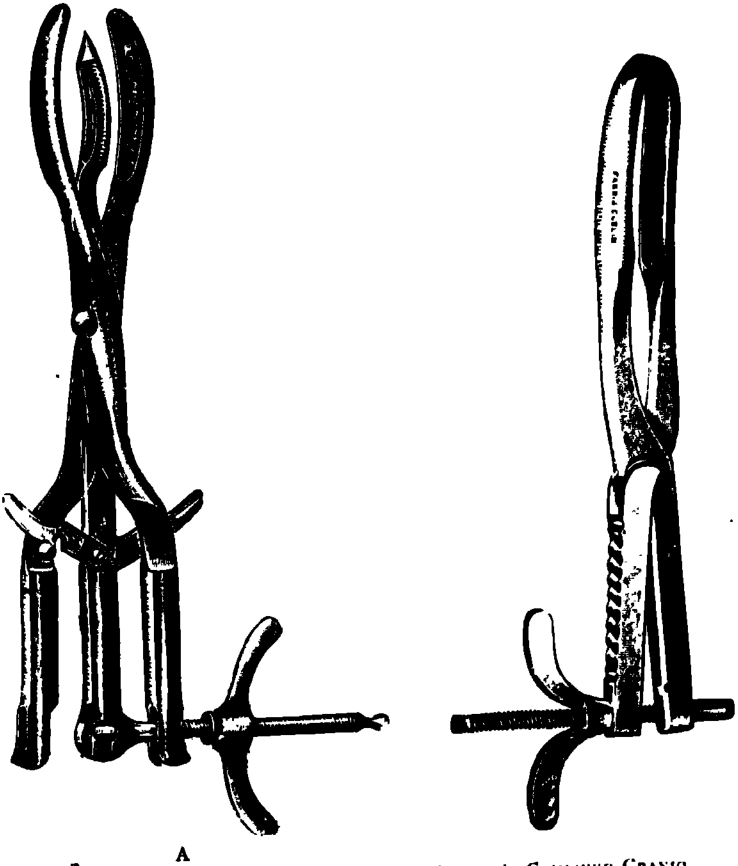

FIG. 451.—A, WINTER'S MODIFICATION OF AUVARD'S COMBINED CRANIOCLAST AND CEPHALOTRIBE; B, BRAXTON HICKS' CEPHALOTRIBE.

Simpson's basilyst differs from it, in that instead of crushing the head from without as with a cephalotribe, it rends the base of the skull apart from within, and then grasps the broken-up head with a cranioclast grip. We have no experience of this instrument, but in Simpson's hands it has proved most satisfactory.*

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* *Trans. Edinburgh Obstet. Soc.*, vol. xxv., p. 86.

Conditions.—Certain conditions must be fulfilled before craniotomy can be performed:—

(1) The pelvis must be of sufficient size to allow the passage of the mutilated fœtus. In the case of a flattened pelvis, the true conjugate must measure at least 2¼ inches, in the case of a generally contracted pelvis at least 2½ inches.

(2) The uterine orifice must be sufficiently dilated to permit the necessary manipulations.

(3) The head must be fixed in the pelvis, or be held firmly at the brim by an assistant in such a manner that it will not slip away as the perforator is introduced.

Operation.—The operation of craniotomy consists of four steps:—

(1) The perforation of the cranium.
(2) The breaking up and evacuation of the contents of the skull.
(3) The reduction in size of the base of the skull by compression.
(4) The extraction of the fœtus.

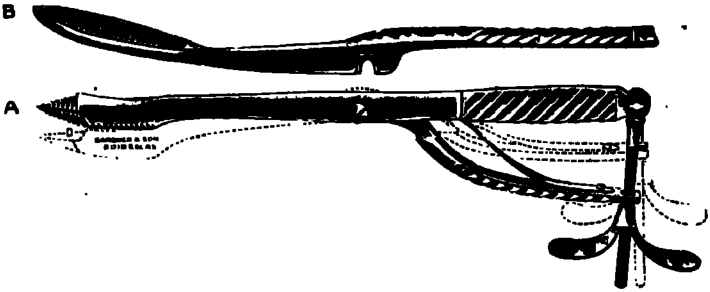

FIG. 452.—SIMPSON'S BASILYST.
A, The blades for screwing into base of skull; B, the cephalotribe blade.

The Perforation of the Cranium.—The patient is anæsthetised and placed in the dorsal cross-bed position, and the parts are thoroughly washed and disinfected. If necessary, preliminary dilatation of the uterine orifice is effected. As much of the left hand of the operator, as is necessary, is introduced into the vagina, and the head pushed into a position of flexion, if it is movable and if it is not already so placed. An assistant then from without holds the head firmly in this position, while the locked perforator is cautiously guided through the vagina under protection of the left hand, until the point rests against the most dependent part of the cranial vault, as shown in Fig. 453. The lock of the instrument is opened and the blades are separated by pressing the handles together, thus making two lateral cuts in the cranial bones. The instrument is then closed and partially withdrawn to permit of it being rotated through ninety degrees. It is then again opened, and a second cut made at right angles to the first. In introducing the instrument, the greatest care must be taken that it does not slip. It is to prevent such an accident that we advise the introduction of the perforator through the most prominent part of the head, whether this entails its passage through a bone or a suture. Steady pressure upwards is also essential, and all jerking or sudden movements must be avoided, as, if the instrument was to slip, most serious injury might be done to the maternal tissues.

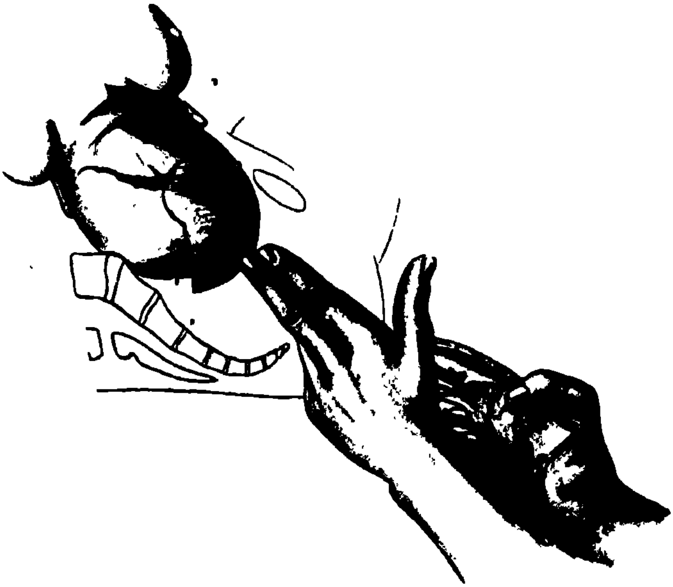

FIG. 453.—THE PERFORMANCE OF CRANIOTOMY: THE INTRODUCTION OF THE PERFORATOR.

In face presentation, the perforator can be most easily introduced through an orbit, or, if there is a difficulty in reaching it, through the roof of the mouth. In the latter case, however, the bones which have to be traversed are firmer, and consequently a greater degree of force has to be used.

In the case of the after-coming head, perforation may be at times very difficult, if pelvic contraction prevents us from drawing the base of the head within reach. There are two sites, at either of which the perforator can be introduced. Either the body of the child may be drawn as far backwards as possible and the perforator introduced through the occipital bone, or the body may be drawn forwards and to one side, and the perforator introduced through a lateral fontanelle. The former method is perhaps the easier. An assistant seizes the child by the legs and draws it forcibly as far backwards as possible, while the operator introduces the fingers of his left hand between the

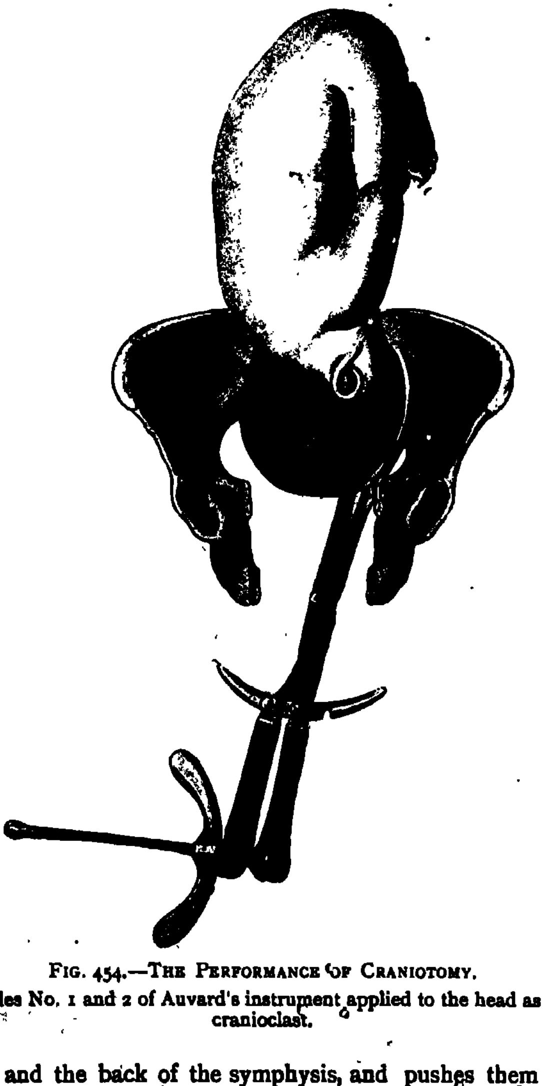

FIG. 454.—THE PERFORMANCE OF CRANIOTOMY.

Blades No. 1 and 2 of Auvard's instrument applied to the head as a cranioclast.

occiput and the back of the symphysis, and pushes them up as far as possible. The perforator held in the other hand is then pushed through the highest point of the bone that is under the protection of the vaginal fingers. If the body of the fœtus is of large size and fills the pelvic cavity, while at the same time pelvic contraction keeps the head unusually high, it may be conceivably necessary first to remove the body by performing decapitation, and then to crush and extract the separated head.

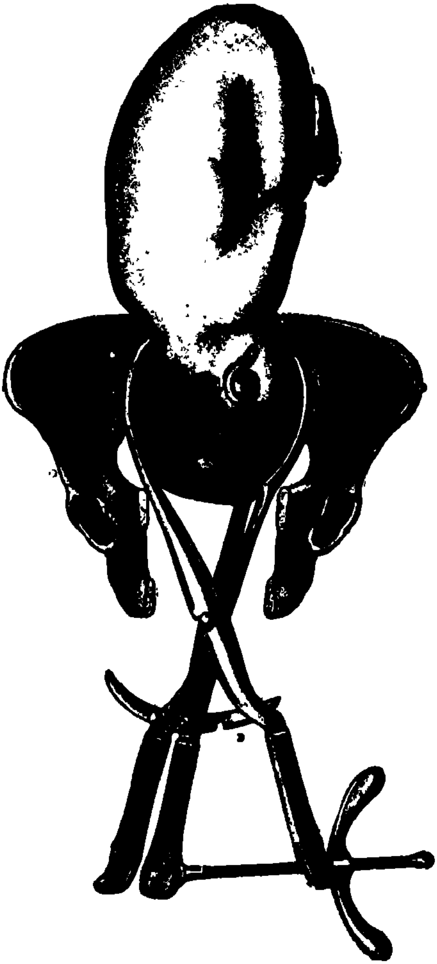

FIG. 455.—THE PERFORMANCE OF CRANIOTOMY.

Blade No. 3 of Auvard's instrument applied over the back of the head so as to unite with the others to make a cephalotribe.

The Breaking up and Evacuation of the Brain.—The second step consists in removing as much of the brain as possible. With this object the perforator is pushed up to the base of the skull, and moved about freely in all directions so as to break up the brain as completely as possible. The more fully this is done the easier will be the subsequent evacuation. A large-sized Bozemann's catheter is then introduced, and a stream of water

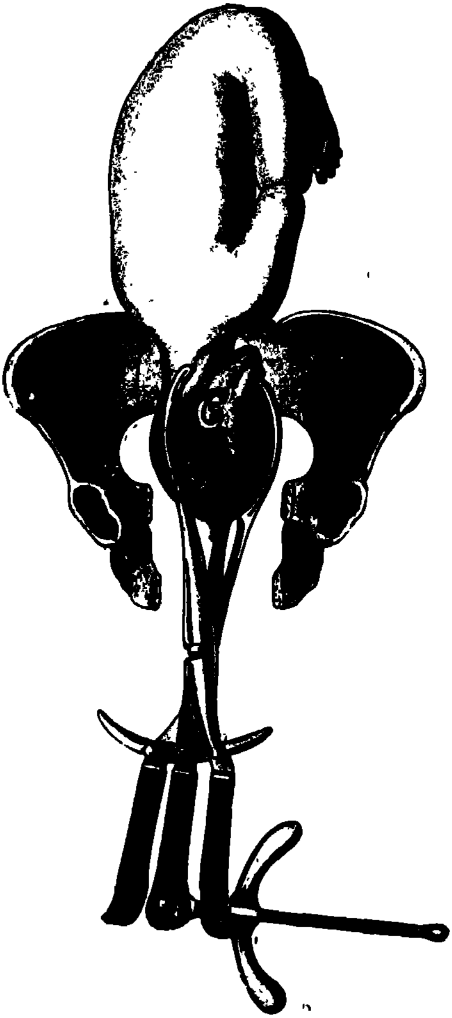

FIG. 456.—THE PERFORMANCE OF CRANIOTOMY.

Auvard's instrument applied, the handles screwed together, and the head crushed.

allowed to run through it with the object of washing out the disintegrated brain. Much time need not, however, be spent over this part of the operation, as, when traction is applied to the head, the compression of the latter will squeeze the brain out through the opening in the vault.

The Reduction of the Skull.—If Auvard's combined instrument is used, the centre blade, marked No. 1, is passed upwards through the opening in the cranium and as deeply as possible into the base of the skull, taking care that its convex surface is turned towards the face of the fœtus. Blade No. 2, which unites with blade No. 1 to form a cranioclast, is then applied over the face, and the two blades tightly screwed together by means of the compression screw at the end of the handles (*v.* Fig. 454). The head is now caught in a cranioclast, and, if the disproportion between it and the pelvis is not very great, a sufficient degree of reduction will probably be obtained by traction. As the head passes through the pelvic brim, it elongates as shown in the diagram (*v.* Fig. 450), and the remainder of the brain is squeezed out. If, however, the disproportion is considerable, blade No. 3 must be applied over the head at the side opposite to blade No. 2, with which it forms a cephalotribe (*v.* Fig. 455). It is then locked, and the two blades screwed together by means of the compression screw, as shown in Fig. 456. If the blades have been so applied that they include the base of the skull in their grip, a marked degree of reduction is obtained. If one application of the cephalotribe does not sufficiently reduce the size of the head, the instrument should be taken off and re-applied to the head in a diameter at right angles to its former position.

Simpson's basilyst also consists of three blades, two of which interlock to form an instrument with a screw-ended tip, while the third can be applied outside the head to form with the others a cranioclast. The first two blades interlocked are introduced into the cranial cavity and screwed into the base of the skull. Then the handles are compressed and the blades separated, with the result that the bones of the base are split apart. If necessary, the instrument is then rotated through a right angle and the blades again separated. So great a breaking up of the base of the skull results from this, that, if the disproportion between the head and the pelvis is not very great, the head can be pushed down through the pelvis by pressure applied from without. If this cannot be done, the third blade is applied outside the skull and the head extracted as with a cranioclast.

Extraction.—In consequence of the crushing force being applied to one diameter, there is always a tendency to a compensatory increase in the opposite diameter, and consequently it is advisable to rotate the head during extraction by means of the cranioclast in such a manner that its greatest diameters correspond to the greatest diameters of the pelvis. Traction must be applied in the axis of the pelvic canal, and, during the descent of the head, repeated examination must be made with the fingers in the vagina to ascertain that pieces of broken bone are not protruding through the cranial skin, as severe laceration of the maternal soft parts can be brought about by such pieces.

It was formerly not infrequently taught that, after perforation and crushing, it was advisable to leave the expulsion of the head to the natural efforts. Such a course is, however, now seldom or never recommended, and is quite opposed to the principles that govern modern obstetrical practice. Everything points to the advisability of delivering the woman. She is already anæsthetised, she has probably been for a considerable time in labour and requires to be delivered, and the retention of the dead fœtus in the uterine cavity favours the occurrence of saprophytic infection.

Prognosis.—There should be no maternal mortality associated with craniotomy, if the operation is performed in time and is not attempted in the case of absolute pelvic contraction. As, however, the operation is as a rule postponed until the last moment, in order to give the infant every chance of being expelled spontaneously, it may happen that it is performed in the case of patients who are seriously collapsed, or who have been infected by previous manipulations. There is no excuse for such a postponement when the infant is dead, and the operation should be performed as soon as it is plain that, without it, delivery cannot be effected *per vaginam*. There is always some risk of laceration of the maternal soft parts by pieces of projecting bone, and this must be guarded against, by carefully noting the effect of traction on the cranial bones, and by removing any pieces which protrude through the cranial skin.

EMBRYOTOMY

The term embryotomy strictly means any cutting operation performed on the fœtus, but, in practice, it has come to mean any cutting operation performed on the body of the fœtus with the object of reducing its size or altering its shape. Three different operations are included in the term;—Decapitation, evisceration, and cleidotomy.

DECAPITATION.—By decapitation is meant the separation of the head of the fœtus from its body by cutting or tearing through the neck.

Indications.—The operation of decapitation is seldom required in obstetrical practice. Its chief indication is neglected shoulder presentation in which version cannot be performed, and in which the neck can be reached, and such cases, as the name implies, only occur when the patient has been neglected during labour. Decapitation is also indicated in cases of locked twins, when the after-coming head of the first has become interlocked with the forecoming head of the second, and their disengagement is impossible.

Instruments.—In neglected shoulder presentation, the only special instrument that is required is some form of decapitator. Many different forms of instrument have been invented since Ramsbotham* devised his sharp sickle-shaped hook. The instrument most generally used at the present time is the blunt hook devised by Braun, and, though it may not sever the neck with the same rapidity as a sharp hook, it is a safer instrument and most efficient. For decapitation of the after-coming head, all that is required is a pair of strong scissors.

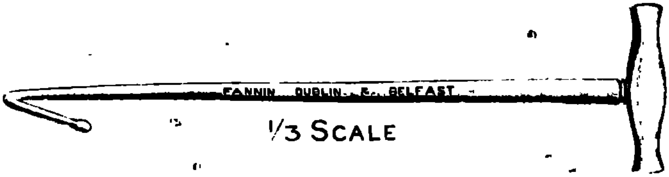

FIG. 457.—BRAUN'S BLUNT HOOK FOR DECAPITATION.

Operation.—The patient is anæsthetised and placed in the dorsal cross-bed position. The presenting shoulder is drawn down as far as possible by traction on the prolapsed arm. The fingers of the hand corresponding to the side at which the head lies are introduced into the vagina, and passed upwards in such a manner as to encircle the neck from behind, the thumb encircling it from in front. The hook is then guided upwards through the vagina along the palm of the hand, and insinuated along the anterior surface of the neck under cover of the thumb, as shown in Fig. 459, until the point is above the neck, when it is turned inwards and drawn forcibly downwards over the neck in such a manner that it includes the spinal column in its crook. The hook is then forcibly rotated so as to fracture the spinal column. The soft parts can be severed either by twisting them away with the hook or by dividing them with blunt-pointed scissors. The head is next pushed up out of the way, and the

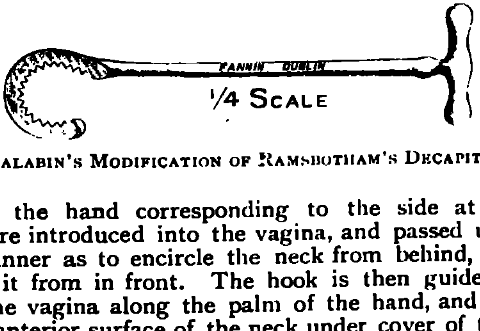

FIG. 458.—GALABIN'S MODIFICATION OF RAMSBOTHAM'S DECAPITATING HOOK.

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* 'The Principles and Practice of Obstetric Medicine and Surgery,' 2nd ed., p. 359.

prolapsed arm is drawn further down so as to bring the other arm within reach. This is in turn pulled down, and the trunk

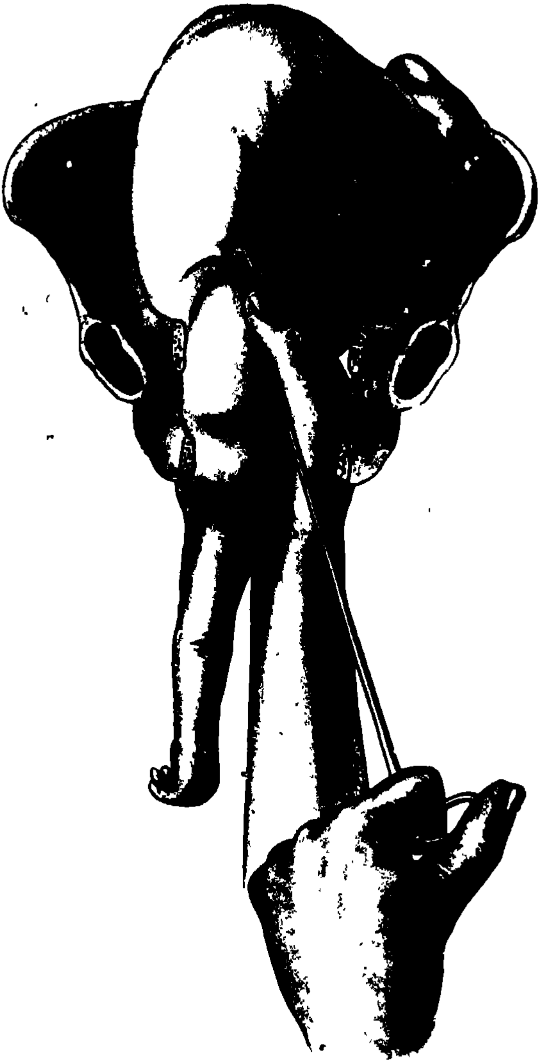

Fig. 459.—Decapitation with Braun's Blunt Hook in a Neglected Shoulder Presentation.

extracted by traction on both arms. If the pelvis is contracted, and the size of the body renders its delivery difficult, the body may be reduced by performing evisceration.

Galabin, who is an ardent believer in his modification of Ramsbotham's hook, recommends that the operation of decapitation be performed as follows:—'Bring the shoulder as low as possible by traction upon the prolapsed arm. The neck can be then generally reached by the left hand passed into the vagina. Carry the decapitator, protected by the flexor surface of the fingers, up in front of the neck, passing it along the arm, the point directed toward the head, until it reaches the level of the neck. Now, draw the decapitator firmly downwards at the same time that its handle is swayed backward and forward as widely as the vaginal outlet will allow. In this way, the neck is quickly cut through.'

The extraction of the severed head is the last step, and in some cases may give rise to difficulty. If there is no contraction of the pelvis, the easiest method of extraction consists in pressing the head down into the pelvic brim with the hand on the abdomen, and in then introducing the other hand into the uterus, and grasping the head with two fingers in the mouth. The head is then delivered as in the case of an after-coming head by traction on the mouth assisted by firm pressure from without. If this does not succeed, one blade of the cranioclast may be introduced into the mouth as recommended by Winckel, the other blade being placed over the divided tissues of the neck, and traction thus applied. If the pelvis is contracted, and delivery of the unreduced head is impossible, the latter must be perforated and crushed in the ordinary manner.

EVISCERATION.—Evisceration is the term applied to the removal of one or more of the abdominal or thoracic viscera, with the object of reducing the size of the fœtal trunk.

Indications.—Evisceration is indicated in longitudinal lies of the fœtus if the size of the fœtal body obstructs delivery after the birth of the head or breech. It is also indicated in neglected shoulder presentations in which the neck cannot be reached and decapitation performed.

Instruments.—The only special instrument required is one with which to make an opening into the trunk of sufficient size to admit the fingers. For this purpose Simpson's perforator, or a pair of strong, long-handled, and sharp-pointed scissors, answers well.

Operation.—The patient is placed in the dorsal cross-bed position and anæsthetised. The hand is passed into the vagina at whichever side there is most room, and the perforator, guided up along it, is pushed into the most accessible part of the thoracic or abdominal cavity. The fingers are then introduced through the hole thus made and the nearest viscus is caught and pulled away. If the opening in the fœtal body is not of sufficient size to permit this to be done, it must be enlarged with scissors. In this way, the liver, lungs, and heart can be removed. As soon as the size of the trunk is sufficiently reduced, the body can be delivered.

In the case of a neglected shoulder presentation, this can be best done by fracturing the spinal column with a Braun's hook, or by cutting it through with a stout scissors. The lower half of the body is then pulled down and the fœtus extracted by a mechanism similar to that which occurs in spontaneous evolution. If the spinal column cannot be fractured, pass the hand upwards into the uterus, seize the feet, and extract the child as a breech presentation.

CLEIDOTOMY.—Cleidotomy is the term applied to the operation of division of the clavicles of the fœtus with the object of reducing the width of the shoulders and of making them more readily adaptable to the pelvic canal. Bonnaire* has shown by experiments on dead children that unilateral cleidotomy reduced the bis-acromial circumference by from one to three centimetres, bi-lateral cleidotomy by from three to four centimetres. The statement made by Bonnaire that in no case on which he experimented was the subclavian artery injured or the subclavius muscle divided is supported by the results of Ballantyne's experiments.† It is possible therefore that the operation can be performed in cases of necessity on the living fœtus without causing its death.

Indications.—Cleidotomy is indicated when the shoulders are impacted in the pelvis in consequence of their large size, of their failure to rotate, or of pelvic contraction, if it is impossible to deliver the fœtus by other means, even after the arms have been brought down. So far as we know, the operation has been performed only on the dead fœtus, either as an accessory to, or without, a preliminary craniotomy.

Instrument.—The only special instrument required is a pair of strong scissors with long handles.

Operation.—The necessity for the operation will usually arise more or less unexpectedly during delivery, owing to the impossibility of delivering the shoulders after the birth of the head. In such cases, every effort must be made to deliver the infant in the manner which has been already described when discussing the treatment of impacted shoulders, and, if such efforts fail, the patient should be rapidly drawn into the cross-bed position, and cleidotomy performed. In performing the operation, two fingers are slipped into the vagina along the anterior aspect of the child, until the prominent ridge formed by the clavicle is felt. The scissors is then guided upwards under cover of these fingers until it comes to the clavicle, when it is gently and carefully opened just wide enough to admit the bone, and the latter is divided at or near its middle. As soon as division is complete, the bones will override one another. If there is any possibility that the fœtus is alive, care must be taken to divide the bone alone, and not to injure the structures lying under it. Attempts to deliver the fœtus may be then repeated, but if they are unsuccessful the opposite clavicle must be divided in a similar manner.

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* 'De la réduction des épaules dans l'accouchement dystocque,' *Presse Médicale*, No. 21, p. 125, Mars 14, 1900.

† 'Cleidotomy,' *Trans. Edinburgh Obstet. Soc.*, vol. xxvi., p. 24.

We have recently had to perform cleidotomy in the case of a large infant, whose shoulders were arrested on account of their size. The right shoulder remained above the brim, and the left shoulder descended into the cavity. Traction had failed to deliver, the arms could not be brought down, and the fœtus was dead. Both clavicles were divided with scissors, and traction again made without result. The skin over, and the posterior muscular attachments of, the right scapula were then divided with scissors, and the scapula and shoulder thus enabled to move round towards the front of the chest. Delivery was then easily effected by traction. The infant weighed ten pounds. The bis-acromial circumference, when the shoulders were placed in their normal position, measured forty-five centimetres;* when the circumference was compressed, the division of the clavicles and of the scapular muscles enabled it to be reduced to thirty-three centimetres. The value of the division of the scapular muscles in enabling a further reduction in the shoulder-girdle after cleidotomy is shown by this case to be considerable.

It is interesting to note that, in this case, the sub-clavicular vessels were not injured during the division of the clavicles, though the vessels on the right side were divided during the subsequent procedure. In performing cleidotomy, if there is any chance that the infant may be still alive, it is important to make the division as near the scapular end of the bone as possible, as the farther out it is made the greater the distance between the vessels and the clavicle, and hence the less risk there is of injuring the former.

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* The bis-acromial circumference normally measures thirty-four centimetres.

PART X

THE INFANT

CHAPTER I

THE PHYSIOLOGY AND CARE OF THE INFANT —INFANT FEEDING

The Management of the Infant after Birth, Ligation of the Cord, Dressing of the Umbilical Wound—Temperature, Pulse and Respiratory Rate of Infant—Urine—Meconium—Weight. Infant Feeding—Breast Feeding, Composition of Cow's and Human Milk—The Wet-nurse—Artificial Feeding, Proprietary Foods, Cow's Milk—General Remarks on Infant Feeding.

THE PHYSIOLOGY AND CARE OF THE INFANT

We must now return to the commencement of the third stage of labour for the purpose of describing the management of the infant after birth. Immediately the infant is born, the nurse should wipe its eyes with a soft linen cloth in order to remove any material which may have found its way into them during the passage of the head through the vagina, and the mouth is similarly treated if it contains mucus. Usually, the infant then cries, if it has not already done so, and commences to breathe naturally. If it does not do so, the finger should be passed into the mouth and any mucus which may be far back gently hooked out. This procedure is greatly facilitated by suspending the child by the feet, as this enables the mucus to run out of the larynx. As soon as all mucus has been removed, attempts must be made to make the infant inspire, if it has not already done so. Usually, some slight cutaneous stimulation is all that is necessary, such as a dash of cold water or a gentle slap with the hand. If this is not sufficient there must be some pathological condition present, which will be considered under the head of asphyxia neonatorum. As soon as the infant is breathing strongly, it is laid between the mother's thighs, a little way from the vulva, and in such a position that it will not be pressed upon by the mother and that there is no tension on the cord.

The next step consists in the ligation of the cord. The old dispute as to when the cord should be tied possesses now little more than an academic interest, as it is conclusively settled that this should not be done until all pulsations in the cord have ceased. Formerly, it was customary to tie the cord the moment the fœtus was born, or as soon as it had cried lustily, and in spite of the representations of White of Manchester, this practice continued up to comparatively recent times. White, who was perhaps the most scientific obstetrician of his day, clearly recognised the absurdity of supposing that it was possible for the change from the placental to the pulmonary circulation, with all that this implies, to take place in a moment. 'Is it possible,' he writes, 'that this wonderful alteration in the human machine should be properly brought about in one instant of time, and at the will of a bystander? . . . By this rash and inconsiderate method of tying the navel string before the circulation in it is stopped, I doubt not but many children have been lost.'* The experiments of Budin and of Ribemont-Dessaignes have set the question at rest.

Budin† has proved that an infant, in whom the pulsations of the cord are allowed to cease before ligation, gains on an average 92 grammes (3 oz.) of blood, which it would have otherwise lost, a loss which would be equivalent to one of sixty ounces in the adult. It is possible that this extra blood may find its way into the fœtal circulation in one of two ways. First, it may be sucked in from the placenta—thoracic aspiration—as a result of a negative pressure in the great vessels near the heart owing to the establishment of the pulmonary circulation and the demand for additional blood; or, secondly, it may be forced into the fœtal vessels owing to the contraction of the uterus upon the placenta (Schucking and Porak). In the first event, it would be clearly advisable to permit the influx of blood to occur; in the second event, it would probably be inadvisable to do so. Ribemont-Dessaignes‡ has, however, shown, by observations on the blood-pressure of the umbilical arteries and vein in cases of immediate and late ligation, that the influx of blood is due to thoracic aspiration. The suggestion that jaundice is more common in the case of late ligation of the cord has been disposed of by Schmidt,§ as his observations showed that 72 per cent. of children in whom immediate ligation was adopted were jaundiced, while only 42 per cent. were jaundiced when the cord was not tied until ten minutes after birth. The occurrence of jaundice is not in itself a matter of very great importance, as, in its common form, it is probably due to the breaking down of blood corpuscles, and not to absorption of bile. An additional argument in favour of late ligation, if one is required, is the fact that infants in whom this course is adopted are stronger, and gain more rapidly in weight.

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* 'A Treatise on the Management of Pregnant and Lying-in Women,' etc., third edition, p. 109 *et seq.* London, 1785.

† 'À quel Moment doit-on opérer la Ligature du Cordon ombilicale?' *Progrès Méd.*, 1876.

‡ *Arch. de Tocol.*, October, 1879.

§ *Archiv f. Gyn.*, vol. xlv., 1894.

The question, When is the cord to be tied? being thus answered, we must now discuss the equally important question, How is it to be tied and divided?

The difference in the opinions held regarding the proper method of treating the cord after the birth of the infant is perhaps one of the most surprising things in modern obstetrics, especially when one considers the apparent simplicity of the question, and the ease with which its answer can be experimentally determined. In spite of this, at the present time there are advocates of the use of the ligature and of the use of no ligature; of division with the scissors; of amputation round the skin edge; of the application of clamps, and of division with the thermo-cautery; of dry dressings, of wet dressings, and of no dressings. In spite of all these numerous practices, or, perhaps it would be more correct to say, in consequence of them, the essential details of the treatment of the cord are apt to be overlooked. To constitute a suitable method of treatment, two conditions must be fulfilled:—

(1) It must be a simple method, capable of being carried out by any reasonably skilled person, and under any circumstances.

(2) It must preserve the initial asepsis of the cord.

The first condition will at once sweep out of the field all such proposals as that of primary amputation of the cord proposed by Dickinson.* This may furnish admirable results in cases in which it can be properly performed, and at the same time may be simple in its technique; but it is not suitable for use in the majority of cases, and hence there does not appear to be any particular object to be gained by its use in a small proportion of cases. For similar reasons, the use of clamps (Bar †) or of the thermo-cautery is not desirable. The abolition of the ligature is also contra-indicated, in that though in many cases it is not necessary, in others it is necessary, and the great majority of persons who conduct labours will never be sufficiently skilled to be able to distinguish the cases in which ligation is required from those in which it is not. It is true that Kellar ‡ has recorded 2,000 cases of non-ligation with good results, but, even so, the practice cannot be recommended for general adoption.

The second condition can be fulfilled in a number of ways, but it is necessary to select one which will also fulfil the first condition. Perhaps, the easiest and safest method to adopt is one which will prevent any non-aseptic material or instrument from coming into contact with the cord, and which will keep the latter dry, and so encourage the desiccation of the stump

A method which fulfils both these conditions, so long as due attention is paid to asepsis, is the well-known practice of tying the cord with stout linen thread and dividing it with scissors. The ligature with which the cord is tied and the scissors with which it is divided should be as sterile as are the ligatures and instruments for use in any surgical procedure. The same remark applies also to the dressings which are subsequently applied. The cord is tied in two places, one ligature being placed two inches from the umbilicus of the child, and the other as close as possible to the vulva of the mother. The object of the second ligature will be subsequently explained. The cord is then divided half an inch above the first ligature, a pad of dry sterilised cotton-wool is applied to the umbilicus, and the remainder of the dressing postponed until the infant has been washed. Linen thread doubled and with knotted ends is generally used for the ligature. It should be boiled before use, or else allowed to lie in corrosive sublimate solution (1 in 500) for several hours.

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* 'Complete Amputation of the Umbilical Cord,' *Trans. of the American Gynæcol. Soc.*, 1893, p. 267.

† 'Peau de Cerf.,' *Revue Intern. de Méd. et de Chir.*, 1897, No. 16.

‡ 'Non-ligation of the Umbilical Cord,' *Pacific Med. Journ.*, January, 1897.

If the cord is very 'fat'—*i.e.*, if there is a large amount of Whartonian jelly, it is sometimes difficult to tie the ligature sufficiently tightly to prevent oozing from the cut surface. In such cases, Budin* recommends that the ligature be about twelve inches in length. The cord is first tied circularly as before, and cut off one centimetre above the ligature. The ends of the latter are then brought over the face of the cut surface, and tied again in such a manner that they lie at right angles to the first loop, and that they divide the portion of cord beyond the first ligature into two parts, in one of which is the vein and an artery, in the other the second artery. Finally, each of these parts is tied separately with the ends of the same ligature.

It sometimes happens that the cord is very soft, and that a ligature made of linen thread cuts through it. In such cases, some softer and thicker material must be used as a substitute for thread, such as a piece of circular lampwick, similar to what is used for drainage purposes, and of about the thickness of a goose-quill.

The object of the second ligature in the majority of cases is merely to serve as an index upon the cord by means of which we can watch the elongation of the portion which lies outside the vulva, and so determine whether the placenta has descended into the vagina or not. In cases of twins, it is also required in order to check hæmorrhage from the placental end of the cord, a complication which might otherwise occur in consequence of an anastomosis between the circulation of the infants.

As soon as the mother has been comfortably settled, the toilet of the infant must be performed. This should be preceded by a careful examination, to ascertain that neither defects nor deformities are present, nor injuries which have occurred during delivery. The urethra and the anus must be specially examined to note that they are patulous. The infant is then washed carefully by the nurse in the ordinary manner. If there is an unusual amount of vernix caseosa, it is well to first rub the infant over with a little olive-oil or vaseline, and then to wash this off with soap and water. The eyes must be carefully cleansed for the second time, and all concretions in the canthus washed away. In all cases in which there is any inflammatory condition of the vagina of the mother, whether there is a definite history of gonorrhœa or not, Credè's prophylactic treatment of ophthalmia neonatorum must be adopted.* This consists in dropping into each eye one drop of a two per cent. solution of nitrate of silver. A one per cent. solution has been found to answer the same purpose in the wards of the Rotunda Hospital. Of late, a twenty per cent. solution of argyrol has been recommended instead of nitrate of silver. It is less irritating and apparently just as efficacious, and so in our opinion is preferable. In institutions, prophylactic measures should be adopted as a routine practice.

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* 'Ligature du Cordon, nouveau Procédé,' *Congrès de Bordeaux*, August, 1895, p. 500.

As soon as the infant is washed, the cord is carefully dried, and then dusted over with an antiseptic powder, such as equal parts of boracic acid and starch, or bismuth and starch, and covered with sterilised cotton-wool, if such can be obtained, or with wool impregnated with a mild antiseptic. This dressing is removed night and morning, the cord powdered, and a fresh pad applied. On account of the great importance of keeping the cord dry, many writers recommend not to bath the infant until the cord has separated and the navel healed. This is a point which is worthy of more attention than it usually receives. Bastard,† writing in 1897, stated that in the case of two sets of infants, to one of whom a daily bath was given and to the other only one bath at birth, the cord separated in the unwashed infants on an average after 5·4 days, while in those that were washed it took an average of 7·4 days. Further, pathological disturbances, such as erythema and suppuration of the stump, occurred in the washed infants in 19 per cent. of cases, in the unwashed infants in 6·3 per cent. These figures are striking, and in view of the fact that the necessary cleanliness can be maintained by sponging over the infant without allowing the umbilicus to get wet, it would seem to be advisable to omit the bath until the navel has healed. Pinard has followed such a course since 1891 (Dickinson).‡

If the primary asepsis of the cord has been preserved, the latter will gradually dry up and mummify, and separate between the fourth and the seventh day. The umbilical arteries then gradually shorten, and the stump of the cord is drawn into the umbilicus, which it fills, so preventing the occurrence of an umbilical hernia.

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* 'Die Verhütung der Augenentzündung beim Neugeborenden,' Berlin, 1884.

† 'Contribution à l'Étude du Traitement du Cordon ombilicale, etc., Action des Bains' (Thése de Paris, Steinheil, 1897).

‡ *Op. cit.*, p. 306.

4 The usual temperature of a newly-born infant is about 99·8° F. This temperature falls a little after the first bath, and then ranges between 98·8° and 99° F. A temperature of more than 100° F. must always be considered to be pathological. The easiest method of taking the temperature of an infant consists in passing the bulb of the thermometer into the rectum. 5 When the infant is awake, the rate of respiration varies even in perfect health between the rather wide limits of thirty and sixty per minute. During sleep, the rate is more regular, and is slightly more frequent. 6 The pulse-rate is also somewhat irregular, and is easily increased by any excitement such as crying, or while suckling. Its correct rate can be best determined when the infant is asleep, either by feeling the pulse at the wrist or over the heart, or by counting the pulsations of the anterior fontanelle. The average pulse-rate during the first two months is 137 per minute, from the second to the sixth month 128 per minute, and from the sixth to the twelfth month 120 per minute.

The urine of the newly-born infant is slightly acid, of a pale yellow colour, and of a specific gravity of 1005 to 1007. It is passed from six to fifteen or twenty times daily. During the first two or three days after birth, the daily amount varies between three and twelve drachms, and this gradually increases until by the sixteenth or seventeenth day, it amounts to between fifty-seven and eighty-five drachms.

Retention of urine occasionally occurs during the first twenty-four hours after birth, and on this account it is always the duty of the medical attendant to inquire at his first visit if the baby has passed water. The usual cause of retention is the blockage of the orifice of the urethra by a small plug of vernix caseosa, which in the male infant may be found beneath the prepuce, in the female infant between the labia. Occasionally, the cause of the retention may be more serious, and be found in some congenital obstruction to the passage of urine, such as an imperforate urethra. If an unduly large amount of urine is allowed to accumulate in the bladder, the latter can be felt as a tense tumour reaching as high as the umbilicus. In such cases, a condition of paresis of the bladder wall sets in, and the infant is unable to empty the bladder even after the obstruction has been removed. If the infant does not pass water within a couple of hours of its birth, the orifice of the urethra must be examined, and any collection of vernix removed. If the infant still does not pass water apply a warm stupe to the lower part of the abdomen, and, if this fails, place the infant in a hot bath, and allow it to remain there for a short time. By holding the hand in front of the urethral orifice, it will be possible to tell if the urine is expelled or not. The administration of a couple of drachms of cold water, while the infant is in the bath, is also said to assist in causing micturition. If these measures fail, and if the bladder is distended, a catheter must be passed. If there is no obstruction present, there will not be any difficulty in passing a No. 1 or 2 catheter in the case of a male infant, or a small-sized female catheter in the case of a female infant.

The meconium is the term applied to the dark-green fluid motions that are passed by the infant during the first few days after birth. The name meconium is derived from the resemblance which the stools bear to thick poppy-juice (μήκων, a poppy). The motions are composed chiefly of mucus coming from the small intestine, mixed with bile and desquamated epithelial cells. In from one to three days, according to the freedom with which the bowels act, the stools assume the usual yellow colour of an infant's motions. They number from two to five in the day, are fluid in consistency, and slightly fæcal in odour. If the infant does not pass any meconium within the first twenty-four hours after birth, there probably is some congenital occlusion in the neighbourhood of the anus or rectum. Such occlusions are due to the non-completion of the process of fusion between the blind end of the hind gut and the anal invagination of the embryo. The most common site of obstruction is at the anus, but, on the other hand, there may be a properly formed anus and anal invagination, with a membranous septum persisting between the latter and the bowel, or the lower part of the rectum may be wanting and only represented by a fibrous cord. With a view to recognising the existence of such conditions, whenever the infant does not pass meconium within a few hours of its birth, the medical attendant should carefully examine the orifice of the anus, and should then pass the tip of the little finger through the orifice in order to ascertain that the canal is patent. If any obstruction is present, it must be, if possible, removed at once and the patency of the canal established. If this course is not possible, an artificial anus must be made through the abdominal wall. The prognosis of these cases is serious, as infants of this age stand surgical procedures very badly.

The average weight of the infant at birth is about seven pounds. During the first two or three days, there is usually a loss of weight of about half a pound, but as soon as the cord has separated and commenced to cicatrise, the infant begins to regain its weight, and, by the end of the seventh or eighth day, is usually as heavy as it was at birth. From this time onwards, it should gain weight steadily, and any failure to do so shows that something is wrong, and that either the infant is suffering from some unrecognised complaint that interferes with its assimilation of food, or that the food it is receiving is not of the proper nature. A gradual and regular gain in weight is one of the most important and reliable indications that the infant is thriving, while a cessation to gain weight, or a loss in weight, is conclusive evidence of the opposite. It is strange how difficult it is to persuade even intelligent and trained nurses of the necessity of weighing an infant regularly, especially when it is bottle-fed. On this account, it is most important that the medical man should personally insist on the infant being weighed weekly, and that if it is found not to have gained in weight, he should ascertain the cause of its failure to do so. The following table shows the average daily and monthly increase in weight of an infant, commencing with an initial weight of seven pounds nine ounces (Fleischmann):—

Month.	Daily Increase.		Monthly Increase.		Weight.		
	oz.	drms.	oz.	drms.	lb.	oz.	drms.
1st	1	3·7	37	0	9	14	0
2nd	1	2·0	33	14	11	15	14
3rd	0	15·8	29	10	13	13	8
4th	0	12·4	23	4	15	4	12
5th	0	10·1	19	1	16	7	13
6th	0	7·9	14	13	17	6	10
7th	0	6·7	12	11	18	3	5
8th	0	5·6	10	9	18	13	14
9th	0	5·6	10	9	19	8	7
10th	0	5·0	9	8	20	1	15
11th	0	4·5	8	7	20	10	6
12th	0	3·3	6	5	21	0	11

INFANT FEEDING

There are three methods by which an infant may be fed:—

(1) Breast feeding by the mother.
(2) Breast feeding by a wet-nurse.
(3) Artificial feeding.

Breast-feeding by the Mother.—This is the natural method of feeding an infant, and should be adopted in all cases in which it is possible, unless there is a direct reason to the contrary on the part of the mother or of the infant. The mother should not nurse the infant for her own sake if she is in a debilitated condition owing to previous or present disease, or to hæmorrhage before or during labour. She should not nurse the infant for its sake, if she is suffering from any disease which she may communicate to it, as phthisis, recently acquired syphilis, or any other infectious disease; if her milk is insufficient in quantity or quality; or if she suffers from any inflammatory condition of the breasts. Occasionally, the condition of the nipples may prevent nursing, either because of their faulty shape—depressed nipples, or because of the pain which the presence of fissures causes during nursing. Difficulties from such causes can, however, as a rule, be overcome. If the nipples are depressed, the mother can usually nurse the infant through a nipple shield or a tetarelle (*v.* Fig. 460), while sometimes it is possible to improve their shape. Fissures only cause a temporary interference with nursing, as they can be easily cured, and, until this is done, nursing can usually be rendered painless by the use of a nipple shield.

If the mother decides to nurse the infant, the latter should be put to the breast as soon as the mother is comfortably settled after labour. The object of this is twofold. The act of suckling reflexly promotes the contractions of the uterus, and the colostrum, that is, the first fluid that comes from the breast, acts as a mild purgative by virtue of the slightly increased quantity of salts which it contains, and so exerts a beneficial effect on the infant by clearing away the meconium. From this on, the baby may be put to the breast every four hours until lactation is established, *i.e.*, about the second day, from which time onwards it must be fed more frequently.

The average composition of colostrum, human milk, and cow's milk is placed side by side in the following table for purposes of comparison. The colostrum analysis is that obtained by Pfeiffer from the results of five cases; the analysis of human milk is based on the results of Pfeiffer, Harrington, Leeds, and others; and the analysis of cow's milk is based on upwards of 140,000 analyses collected from various sources (Holt):—

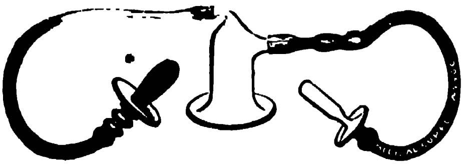

FIG. 460.—A TETARELLE.

Constituents.	Colostrum.	Human Milk.	Cow's Milk.
Proteids (caseine and lact-albumin) -	5·71	1·50	4·00
Fat - - -	2·04	4·00	3·50
Sugar (lactose) -	3·74	7·00	4·30
Salts - - -	0·28	0·20	0·70
Water - -	88·23	87·30	87·50
	100·00	100·00	100·00
Specific gravity -	1040 to 1046	1010 to 1040	1028 to 1033
Reaction - -	strongly alkaline	slightly alkaline	usually acid

The proteids in milk are in all probability caseinogen and lactalbumin, to which a third—lactoglobulin—has been added. Clinically, however, the last named may be considered as identical with lact-albumin (Rotch). The relative proportion in which these substances occur in human and cow's milk is shown by the following figures taken from Koenig:—

	Human Milk. Percentage.	Cow's Milk. Percentage.
Caseinogen	0·59	2·88
Lact-albumin	1·23	0·53
Total proteids	1·82	3·41

The practical importance of this difference will be seen when discussing the preparation of cow's milk for infant feeding.

The salts found in human milk consist of the following (Rotch*):—

Calcium phosphate	23·87
Calcium silicate	1·27
Calcium sulphate	2·25
Calcium carbonate	2 85
Magnesium carbonate	3·77
Potassium carbonate	23·47
Potassium sulphate	8·33
Potassium chloride	12·05
Sodium chloride	21·77
Iron oxide and alumina	0 37
	100 00

The relative composition of human milk and its effect upon the infant are affected by various conditions, and as this is of considerable practical importance, we have drawn the following short account of the most important of these conditions from Holt's † work:—

The Age of the Mother.—This produces no constant effect. The milk of very young women and of those above thirty-five is likely to contain a smaller proportion of fat than the normal.

Number of Pregnancies.—This produces no constant effect.

Acute Illness.—If of a minor character and short duration, this produces no important effect. If of a severe and febrile type, the quantity of milk is reduced, the fat is low, and the proteids high. In septic conditions, bacteria may appear in the milk.

Menstruation.—The effects of menstruation are variable and are not generally understood. In all probability none of importance are produced. On the other hand, from observations on 685 cases, Meyer noted disturbances in the child in over one-half the number. In a case recorded by Rotch, the proportion of fat was low and of proteids high.

Diet.—The proportion of fats and proteids is considerably influenced by diet, while the proportion of sugar is very little influenced. A nitrogenous diet increases uniformly both fat and proteid, a vegetable diet diminishes both. A starvation diet diminishes the fat, while the proteids may be increased or diminished; if the former, they are generally changed in

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[*] 'Pediatrics,' third edition, p. 131.

[†] *Op. cit.*

character. A very rich diet increases fats and usually proteids also. All fluids tend to increase the quantity of milk. Alcohol in the form of malt drinks and malt extracts increases the quantity of milk and the amount of fat; the effect upon the proteids is not constant, but they are probably increased.

Drugs.—The effect of drugs is very uncertain and variable, and is more noticeable when the milk is poor in quality. The most important drugs which affect the infant are belladonna, opium, iodide of potassium, bromides and mercury, saline cathartics, arsenic, and the salicylates. Acids and chloral are without effect.

Period of Lactation.—The most important changes which occur in the milk take place during the first two weeks, and nearly all changes occur during the first month. During the first fortnight, the proteids fall from nearly four to below two per cent. (Pfeiffer), and the salts from 0·45 to 0·20 per cent., while the sugar rises from two to six per cent., and there is a slight increase in fat. After the first month, the variations are so slight that they may be ignored until near the end of lactation, when the proteids fall very markedly.

Pregnancy.—If a nursing woman becomes pregnant, the milk generally becomes small in quantity and poor in quality, especially in fat.

Nervous Impressions.—Nervous impressions of a marked character have a decided and immediate effect upon the milk. An infant who takes the breast under these circumstances may show signs of acute indigestion, such as vomiting and the presence of undigested food in the stools, or there may be, in addition, great prostration, toxic symptoms, and even convulsions. The cause of these disturbances is not understood. It is probable that the proteids are at fault, and that, instead of the normal proteids, others are produced which possess toxic properties.

Breast-feeding by a Wet-nurse.—If the mother is unable or unwilling to nurse her infant, the employment of a wet-nurse, so far as the infant is concerned, is the more suitable of the two methods of feeding that are left. Unfortunately, the difficulty of obtaining a suitable wet-nurse is considerable, and considerations of expense often intervene, so that it is but seldom that this method of feeding is adopted. In certain cases, however, in which the infant is not thriving on the food it has been receiving, and particularly in cases in which previous improper feeding has caused serious intestinal derangements, the employment of a wet-nurse is imperative if the life of the infant is to be saved.

The task of selecting a suitable wet-nurse is often a difficult one, and though the medical adviser can by a careful examination of the proposed nurse decide whether she is probably suitable or certainly unsuitable, the infant itself is the ultimate judge, and a final decision of suitability can only be arrived at when it is found to digest and to thrive on the milk. The following are the essentials for a wet-nurse:—

(1) She must be perfectly healthy, and free from every disease which can be communicated to the infant.

(2) She must be between twenty and thirty-five years of age.

(3) Her breasts must be firm, with well-shaped nipples, and contain abundance of milk.

(4) Her own infant must be about the same age as, or slightly older than, the infant she is going to nurse, and must be thriving well upon her milk. Also, she must be prepared to give up nursing it.

(5) Her character must be sufficiently good to allow of her being brought into the patient's house.

Artificial Feeding.—At the present day, the artificial feeding of infants is not uncommonly substituted for feeding by human milk, in consequence of the necessity for subordinating the feeding of the infant to the occupations of the mother, and also, we fear, in many cases, because the physique of the mother does not enable her to nurse her infant with advantage to either party. Consequently, artificial feeding is too frequently adopted, and though within the last couple of decades great advances have been made in the theory of infant feeding, still, they cannot be said to be commensurate with the growth of the practice. In other words, we fear that the net result of the improvements in, and of the increased prevalence of, artificial feeding is that many infants enter upon their second year of life at a disadvantage as compared with the infants of a previous generation.

Artificial feeding can be satisfactorily accomplished by means of some modification of animal milk, other than human, or by means of some of the proprietary artificial foods. We may dismiss the use of the latter in a couple of sentences. Proprietary foods are inferior to cow's milk, save in occasional cases, in which, in consequence of an enfeebled or disordered digestion, the infant is unable to digest cow's milk. In such cases, an infant may often be tided over the first six months of its life by one or other of these foods. There is always a difficulty in selecting the particular food which is suitable for a particular infant, and we must confess that we know of no method of deciding the point save by noting the effect on the infant. We may select a suitable food at the first attempt, or, as in the selection of a wet-nurse, we may have to try several different foods before we find the one which the infant digests satisfactorily.

The milk of different animals, notably the mare, ewe, ass, and goat, have been occasionally used for infant feeding, but, on account of the obvious difficulties in obtaining a sufficient supply, the milk of the cow is for practical purposes the only one we need take into consideration. We have already noted the principal analytical differences between cow's milk and human milk. We have seen that cow's milk contains more proteids and salts, and less fat and sugar than does human milk, and, further, that the amount of proteid substance in cow's milk that is coagulable by an acid, *i.e.*, caseinogen, is four times greater than the non-coagulable proteid, *i.e.*, lact-albumin, while in human milk the amount of non-coagulable proteid is twice as great as the coagulable proteid. Lastly, we knows that cow's milk as it is received by the consumer is faintly acid in reaction, and contains large quantities of micro-organisms, whereas human milk is alkaline and sterile. With these marked differences existing between the two milks, it would at first sight seem as if it was imperative to very greatly modify the constitution of cow's milk before it can be a suitable food for the nursing infant. Practice, however, does not lend entire support to this very rational belief, and, in consequence, we shall find that, if we sift the large mass of literature dealing with the subject of infant feeding, opinions are very widely divided, and that while the majority of writers teach that the composition of cow's milk should be so altered as to make it approach that of human milk as nearly as possible, others advise the use of 'whole milk,' undiluted and unaltered, provided that it is first carefully sterilised.

The number of different methods of modifying or 'humanising' cow's milk is very considerable, and to describe each individual method would require a special work. The different methods may be divided into two classes, those which may be termed laboratory methods, as taught by Holt and Rotch, in which the correct percentage of the different constituents of milk is carefully obtained, and those which may be termed clinical methods, in which the approximately correct proportions are obtained more or less by rule of thumb.

Feeding by one or other of the 'laboratory methods' has much to recommend it when it is carried out on a large scale, but, for private use, it is too complicated in its working to be successful. Nevertheless, for the benefit of anyone who may care to understand the principles on which it is based, we give a few tables compiled from Holt's work on the subject.

The first table shows the percentage of fat, sugar, and proteid, which should be present in the infant's food during the first twelve months of its life:—

Age of Infant.	Fat.	Sugar.	Proteid.
	Per Cent.	Per Cent.	Per Cent.
1st to 14th day - - -	2·0	6·0	0·60
2 to 4 weeks - -	2·5	6·0	0·80
1 to 3 months - -	3·0	6·0	1·00
3 to 5 „ - - -	3·5	6·0	1·25
5 to 9 „ - - -	4·0	7·0	2·00
9 to 12 „ - -	4·0	6·0	2·50

These different proportions can be obtained by diluting cream of a known strength with varying proportions of a solution of sugar of a known strength. The standard cream and sugar solutions, which are recommended for this purpose by Holt, are as follows:—

Cream Solutions.—(1) A twelve per cent. cream, that is, cream containing twelve per cent. of fat. This is obtained by adding two parts of ordinary skimmed or gravity* cream to one part of plain milk, or by using equal parts of centrifugal cream and plain milk.

(2) An eight per cent. cream, that is, cream containing eight per cent. of fat. This is obtained by adding one part of gravity cream to two parts of plain milk, or one part of centrifugal cream to three parts of plain milk.

Sugar Solutions.—(1) A six per cent. solution, made by dissolving an ounce of milk-sugar in sixteen and a half ounces of water, or an even tablespoonful in six and a half ounces of water.

(2) A seven per cent. solution, made by dissolving an ounce of milk-sugar in fourteen ounces of water, or an even tablespoonful in five and a half ounces of water.

(3) A ten per cent. solution, made by dissolving an ounce of milk-sugar in ten ounces of water, or an even tablespoonful in three and three-quarter ounces of water.

The second table shows the proportion in which these various solutions must be mixed, in order to obtain a milk of the required strength:—

CREAM.		SUGAR.		PERCENTAGE OF		
Parts.	Strength.	Parts.	Strength.	Fat.	Sugar.	Proteids.
1	12 per cent.	5	6 per cent.	2·0	6·0	0·60
1	,, ,,	4	,, ,,	2·5	6·0	0·80
1	,, ,,	3	7 per cent.	3·0	6·0	1·00
1	,, ,,	2·5	,, ,,	3·5	6·0	1·20
1	,, ,,	2	,, ,,	4·0	6·0	1·30
1	8 per cent.	1	10 per cent.	4·0	7·0	2·00

An easy clinical method of preparing a humanised milk, and one which furnishes practically similar results, is shown in the following table:—

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* Skimmed cream removed from milk which has stood for twelve hours contains about 16 per cent. of fat. Centrifugal cream contains about 20 per cent. of fat.

Age of Infant.	Gravity Cream (16 per Cent.).	Plain Milk.	Milk-sugar.	Diluent.
	Drachms.	Drachms.	Teaspoons.	Drachms.
3rd to 14th day -	2½	1½	1½	20
2 to 4 weeks -	3	2	1½	19
1 to 3 months -	4	2	1½	18
3 to 5 ,, -	4	5	1½	15
5 to 9 ,, -	4	8	1½	12
9 to 12 ,, -	3½	12	1½	9½

Instead of milk-sugar, half the quantity of common sugar may be used, and the usual diluent is barley-water. On account of the large proportion of proteid coagulable by an acid which is contained in cow's milk, the latter tends to form a more dense curd in the stomach, and so is thought to be more difficult to digest. Barley-water is believed to break up this curd in a mechanical manner, by separating the milk into droplets, which then coagulate separately. Laboratory experiments have not, however, tended altogether to support this generally accepted belief.

In addition to modifying cow's milk in one of the foregoing ways, it is also necessary to ensure its sterility. If the milk comes direct from the cow to the consumer, and if close supervision is exercised to see that the process of milking is carried out in a cleanly manner, and that the vessels in which the milk is carried are absolutely clean, it is unnecessary to sterilise the milk. If, however, there is any doubt as to its absolute purity, it is advisable to do so. Micro-organisms in milk can be destroyed in one of three ways, by boiling, by 'sterilising,' or by 'Pasteurising.' Boiling prejudicially effects the nutritive value of the milk, and cannot be recommended. Pasteurising consists in raising the milk to a temperature of between 158° and 176° F., and maintaining it at that temperature for thirty to forty minutes. It is perhaps the best method, though it does not effect complete sterilisation, but it is slightly more difficult to carry out, and necessitates the use of a more complicated apparatus. The method, which for want of a better term is called 'sterilising,' consists in placing the milk in a bottle or other receptacle, which is three-quarters immersed in water. The water is then raised to boiling point, at which it is kept for forty minutes. The most convenient form of apparatus for carrying out this process is that devised by Soxhlet, and is shown in Fig. 461. By its means, a number of bottles, each containing sufficient for one feeding, can be prepared at one time, and are kept from subsequent contamination by means of a small rubber cap, which is sucked into the mouth of the bottle as the contents cool.

The use of whole, or undiluted, milk is becoming more common. It was first recommended by Budin, and more recently has been strongly advocated by other writers. Tweedy has adopted this form of feeding at the Rotunda Hospital with considerable success, and our personal experience of it, though not great, is, on the whole, satisfactory. The required quantity of milk is placed in the Soxhlet bottles, and then sterilised as has been described for forty minutes. As even whole milk is deficient in sugar, the deficiency may be made up by the addition of a little milk-sugar. Similarly, the amount of fat may be increased by the addition of cream, or this may be given separately off a spoon. If possible, the cream should be got from a source which does not necessitate sterilisation, as in this way the anti-scorbutic property of milk, a property which is said to be destroyed by sterilisation, is restored.

A healthy infant will thrive on almost any form of humanised milk or on whole milk. The latter is in one way a distinct advantage, as it tends to promote the regular action of the bowels, in all probability in consequence of the relatively larger proportion of non-assimilated residue which is left, and which tends to increase markedly the size of the stools. We, however, still think that for the first three months, at any rate, some modification of the milk is necessary, after that time whole milk may be given with advantage.

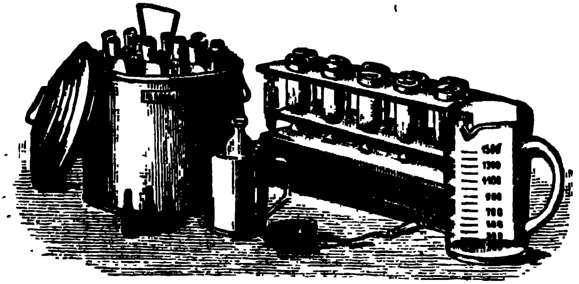
FIG. 461.—THE SOXHLET MILK STERILISER.

GENERAL REMARKS ON INFANT FEEDING.—If the infant is breast fed, it should be put alternately to each breast, and may, as a rule, be allowed to draw as much as it wishes. As soon as it falls asleep, it should be taken from the breast. The nipples should be washed with a little warm water immediately before feeding and immediately after, and the lips should also be carefully wiped with a soft piece of old linen to remove all traces of milk. The number of feedings in the day is the same whether breast or artificial feeding is adopted.

If the infant is fed artificially, attention must be paid not only to the intervals at which it is fed, but also to the amount it receives at each feeding, and to the adoption of strict cleanliness.

The amount which is given at each meal is regulated by the capacity of the infant's stomach (*v.* Fig. 462). This, on an average, at birth is one ounce; at three months, four and a half ounces; at six months, six ounces; and at twelve months, nine ounces (Holt). The following table, also based on Holt's tables, shows the number of feedings in the twenty-four hours during the first year of life, and the amount given at each feeding:—

Age of Infant.	No. of Feedings in the Twenty-four Hours.	Interval between Meals by Day.	No. of Night-feedings (10 p.m. to 7 a.m.).	Quantity at One Feeding.	Quantity in Twenty-four Hours.
		Hours.		Ounces.	Ounces.
1st day - -	4	6	1	1	4
2nd day -	6	4	1	1 to 1·5	6 to 9
3rd to 14th day	10	2	2	1·5 to 2	15 to 20
2 to 4 weeks -	10	2	2	2 to 2·5	20 to 25
1 to 3 months	8	2½	1	3 to 4·5	24 to 36
3 to 5 ,,	7	3	1	4 to 5·5	28 to 38
5 to 9 ,,	6	3	0	5·5 to 7	33 to 42
9 to 12 ,,	5	3½	0	7·5 to 9	38 to 45

If the infant is fed on whole milk, a slightly smaller quantity than is shown in the above table will suffice, but here, as in other cases, we must be largely guided by the special requirements of the infant and by the effect which the food produces. If the infant 'possets' up unchanged milk, it is getting too much fluid. If it passes undigested curds, the milk is too strong. If it digests its food well, but seems always to be hungry, it may get more fluid with proportionately less barley-water, or, if this disagrees, a larger quantity of the usual mixture.

Too little sugar causes a slower gain in weight than is normal; too much sugar causes colic, and also perhaps thin green stools (Holt). Too little fat causes hard dry stools; too much fat causes vomiting or regurgitation of food, and frequent motions, which sometimes contain whitish lumps composed of fat (Holt). Too much proteid matter causes curds in the stools, colic, sometimes diarrhœa, but more usually constipation. The following symptoms show that the child is not receiving sufficient nourishment:—

(1) During the first three days, the temperature shows an inclination to rise. It ranges about 101° to 102° F., and may even reach 104° F. or more. This is the so-called inanition fever (Holt).

(2) The infant ceases to gain in weight.

(3) The infant draws the breast for a long time before it is satisfied. If the milk is abundant, five or ten minutes ought to be sufficient to satisfy it; if the milk is deficient it may require half an hour or more.

(4) Its sleep is irregular and disturbed, and when awakened it frequently cries.

(5) The stools are irregular and of an unhealthy appearance.

The strictest cleanliness must be observed both in the bottles used for feeding and in all vessels in which milk is contained. The feeding-bottle should be boat-shaped, and so have no angles in which particles of milk may lodge. The nipple should fit directly on the neck of the bottle, and on no account should the use of any form of bottle with an intervening tube be allowed.

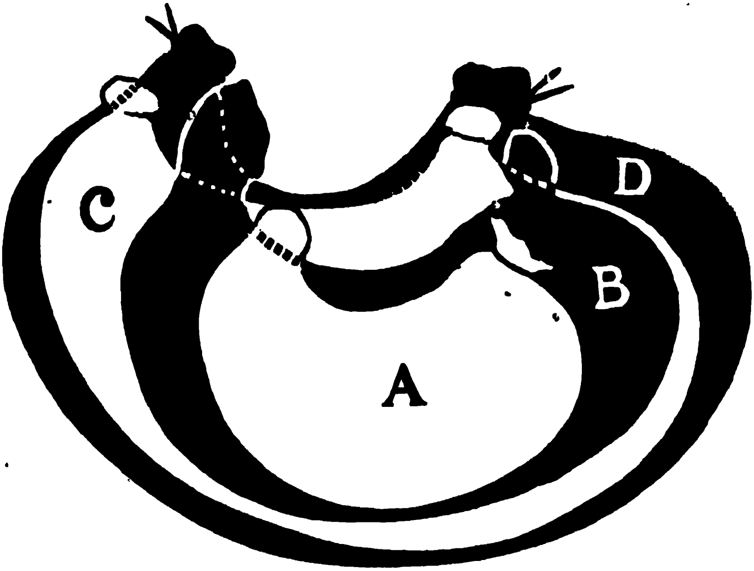

FIG. 462.—DIAGRAM SHOWING THE ACTUAL SIZE OF AN INFANT'S STOMACH AT DIFFERENT PERIODS.

A, At birth, capacity one ounce; B, at two weeks, capacity two ounces; C, at three months, capacity four and a half ounces; D, at six months, capacity six ounces.

The bottles should be washed immediately after use, and when not in use kept in a solution of soda and water, and then again rinsed with plain water before use. On the systematic observance of such apparently small points, the success of infant feeding depends, and if they are neglected, no matter how excellent in other ways may be the system of feeding adopted, it will continually break down.

CHAPTER II

THE PATHOLOGY OF THE INFANT

Asphyxia Neonatorum—Diseases of the Alimentary System, Constipation, Diarrhœa, Thrush—Icterus Neonatorum—Acute Infective Diseases, Ophthalmia Neonatorum, Umbilical Infection, Mastitis—Traumata during Birth; Fractures; Hæmorrhages, Cephalhæmatoma, Hæmatoma of Sterno Mastoid; Nerve Lesions, Central, Peripheral.

ASPHYXIA NEONATORUM

ASPHYXIA NEONATORUM is the term applied to the persistence of complete or partial apnœa after the birth of the infant. The condition is also known as 'the apparent death of the new-born.' Two degrees of asphyxia are met with—*asphyxia pallida*, or white asphyxia, and *asphyxia livida*, or blue asphyxia. In asphyxia pallida, the infant is white when born, its body flaccid, and its heart scarcely perceptible, all attempts at respiration are absent, and there is no response to cutaneous or other stimulation. In asphyxia livida, the condition of the infant is not so serious. It is of a blue or cyanotic colour when born, its body is stiff, its heart beats comparatively strongly, there are spasmodic attempts at respiration, and there is usually a more or less vigorous response to stimulation.

Ætiology.—The common cause of asphyxia is prolonged compression of the fœtus during the second stage of labour, and particularly compression of the funis. Partial premature detachment of the placenta is another cause, but, in such cases, unless delivery is rapid, the death of the fœtus usually occurs. Deep maternal anæsthesia induced by chloroform must, we think, also be reckoned as a cause, but in such cases the recovery of the fœtus is usually rapid and complete. The degree of asphyxia present depends on the length of time for which the supply of oxygen has been lessened or cut off.

Treatment.—The treatment of asphyxia to be successful must be prompt and systematic. The chief objects to be aimed at are the removal of any substance such as liquor amnii or mucus that has been sucked into the throat of the child during premature efforts at inspiration, the establishment of respiratory efforts, and the stimulation of the heart. If the infant is born in a condition of white asphyxia, the cord must be immediately ligated and divided, and the infant held up for a moment by the heels to allow the mucus to run out of its trachea, and then placed in a bath of hot water (100° F.). It is kept in this for a few seconds while further attempts are made to remove mucus from its mouth and larynx. This can be done first with the tip of the finger covered

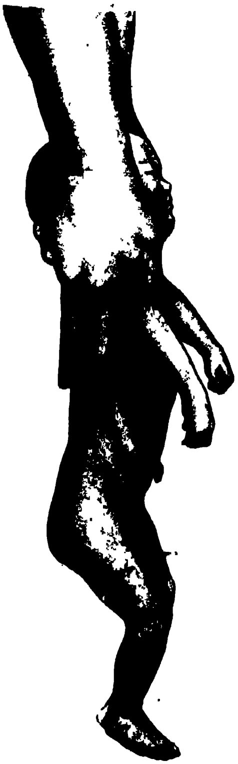

FIG. 463.—SCHULTZE'S METHOD OF ARTIFICIAL RESPIRATION: INSPIRATION.

by a piece of soft linen, and then by aspirating the mucus by a catheter introduced, if possible, into the trachea, or by the special forms of aspirator devised by Ribemont-Dessaignes or by Gibson. The baby is then taken out of the bath, quickly dried to prevent loss of heat from surface evaporation, and some form of artificial respiration is performed five or six times. At first, the most suitable method is the swinging movement introduced by Schultze, and, as increasing efforts at respiration are made by the infant, these may be replaced by Marshall Hall's method. When Schultze's movements have been performed from six to ten times the infant is replaced in the bath, and the same routine is repeated. In performing Schultze's movements, the movements of inspiration and expiration should be made at the rate of from eight to ten in the minute, and, so far as possible, should be made to synchronise with any similar respiratory efforts that are being made by the infant. This routine is continued until either the heart stops or its movements become stronger, and the

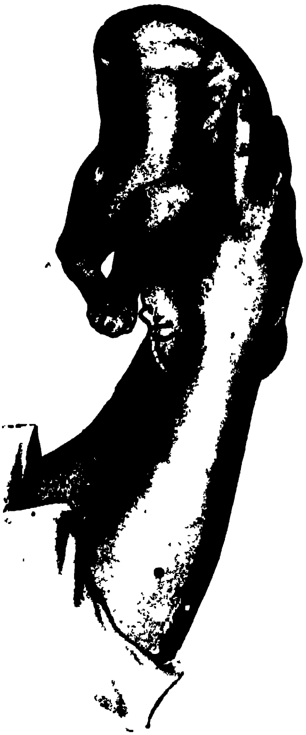

FIG. 464.—SCHULTZE'S METHOD OF ARTIFICIAL RESPIRATION: EXPIRATION.

dead white colour and flaccid condition of the infant disappears. As soon as this occurs, the treatment proper to blue asphyxia may be adopted.

2 If the infant is born in a condition of asphyxia livida, it is not necessary immediately to divide the cord, as to do so deprives the infant of a certain amount of blood. If the heart is beating strongly, all that is at first necessary is to suspend the infant by the heels in order to clear its trachea of mucus, and then to

remove the mucus that has collected in the mouth. As soon as the trachea is clear, the infant will usually respond to cutaneous stimulation, such as a slap or a dash of cold water. If it does not respond to this, the cord may be divided and the infant placed in a hot bath. The larynx and mouth are again cleared as before, and the infant removed from the hot bath and plunged for a moment into a cold bath. It is then dried and artificial respiration performed. A little whisky may also be rubbed on the gums and chest, as the irritation provokes respiration. This routine is continued until the infant makes fairly regular respiratory efforts.

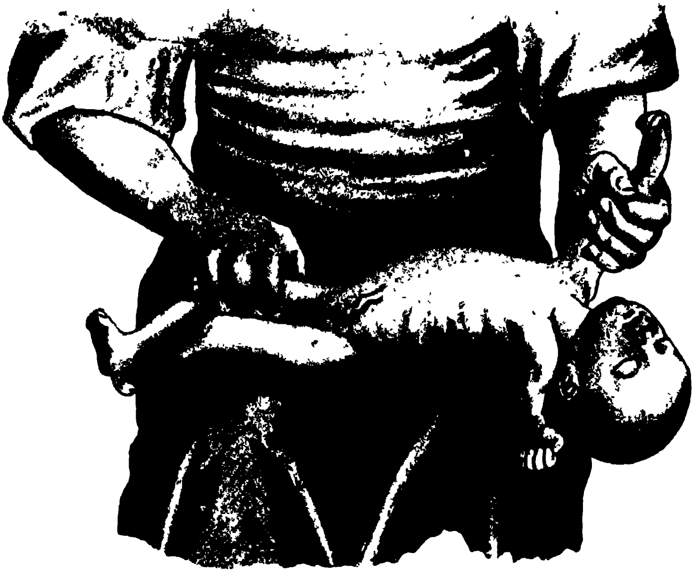

FIG. 465.—MARSHALL HALL'S METHOD OF ARTIFICIAL RESPIRATION : INSPIRATION.

Then, the nurse should take the infant on her lap in front of a fire, and perform Marshall Hall's method of artificial respiration. These movements assist respiration, and, at the same time, probably promote the circulation of the blood and so assist the action of the heart. They should be continued until normal respiration is completely established, and, subsequently, if a condition of partial or complete apnœa should supervene, they must be repeated.

In view of the many not alone incorrect, but even impossible descriptions which have been given of Schultze's method of artificial respiration, it may be of interest to describe it as nearly as possible in his own words.

The child, lying upon its back, is grasped by the shoulders, the open hands having been slipped beneath the head. The three last fingers remain extended in contact with the back, while each index finger is inserted into an axilla, the thumbs lying upon and in front of the shoulders (*v.* Fig. 463). When the child thus held is allowed to hang suspended, its entire weight rests upon the two fingers in the armpits. It is now swung forwards and upwards, and the operator's hands going to the height of his own head, the pelvic end of the child rises above its head and falls slowly towards the operator by its own weight, flexion occurring in the lumbar region (*v.* Fig. 464). The thumbs in front of the shoulders compress the chest, while the hyper-flexed lumbar vertebræ and pelvis compress the abdomen, and through it the thorax; finally, the three last fingers on each side compress the thorax laterally. As a result of this manœuvre when properly done, aspirated secretions flow freely from the mouth. The distended heart also feels the compression, which forces the blood into the arteries. The child is now swung back into its original position, and supported entirely by the fingers in the axillæ. The compression of the thumbs and the three last fingers is removed. The downward swing elevates the sternum and ribs, while gravitation and the traction of the intestines depress the diaphragm. It is often

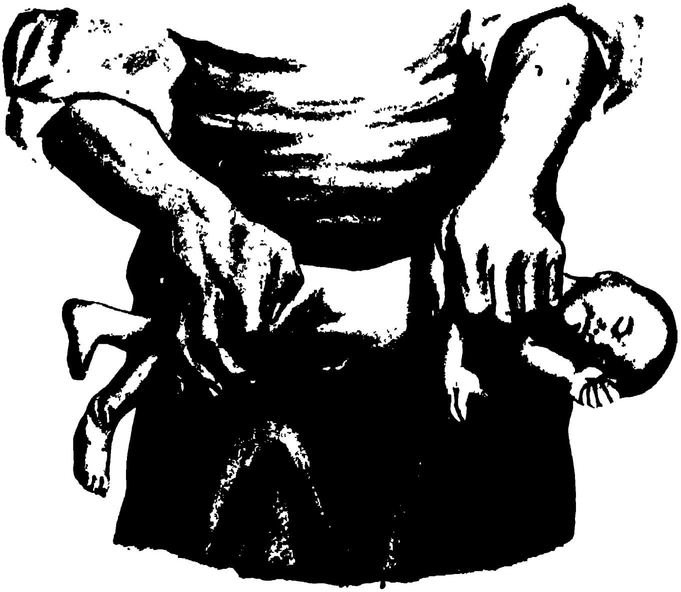

Fig. 466.—Marshall Hall's Method of Artificial Respiration: Expiration.

possible to hear the air rush into the infant's glottis as it reaches the original position, although this can also occur in a cadaver. The amplification of the thorax lowers the intracardiac pressure. The child should be swung up and down ten times for the space of a minute.

We prefer to hold the infant as has been described, save that instead of passing the index fingers from behind into the axillæ, pass the thumbs from in front, keeping the index fingers along the sides of the chest. Then, raise the body with a quick sweep through the air until it reaches the vertical, when it is allowed to gently roll forward on to the thumbs, which have been taken out of the axillæ and placed under the chest. The child is then swung forward as before, and the thumbs at the same time are slipped back into the axillæ.

Marshall Hall's rolling method of artificial respiration is performed as follows:—The medical man or nurse sits on a low chair, preferably near a fire, and lays the infant on its back across his or her knees, as shown in Fig. 465. He then grasps the right arm of the infant in his left hand, at the same time steadying the breech by the pressure of the right hand. The infant is then rolled over on to its left side, and the thorax compressed with the left hand, as shown in Fig. 466. This causes expiration. The infant is then rolled back into its former position, and at the same time its right arm is drawn forwards and upwards in such a manner as to cause an upward traction on the ribs. This movement causes an increase in the diameters of the chest, and so favours inspiration. The movements are repeated rhythmically at a rate of from ten to twelve in the minute, and may be continued for an hour or more.

DISEASES OF THE ALIMENTARY SYSTEM

Constipation.—Constipation is one of the most common of the minor ailments of infancy and also one of the most important, as, although it is itself a minor ailment, its effects are far-reaching. In the young infant it is due, in almost all cases, to improper food, and consequently it is rare in the case of infants breast-fed by a healthy mother. When it occurs in such cases, it will usually be found to be due to an insufficient proportion of fat in the milk, or to be associated with constipation in the mother. Constipation in bottle fed infants is similarly very commonly due to an insufficiency of fats, or to an insufficiency of both fats and proteids. In the latter case, the immediate cause is probably the want of a sufficient residuum in the bowel to stimulate peristaltic movements.

Treatment.—The treatment of constipation should be essentially prophylactic. An infant normally passes from three to five liquid motions in the day, and these are passed without any straining.

If the motions become lumpy and hard, and the amount scanty, immediate steps should be taken to bring them back to their normal condition. The use of drugs should be if possible avoided, and, instead, the quality of the food changed. If the infant is breast-fed, the health of the mother must be attended to, her dietary increased in fats and proteids, and any tendency on her part to constipation corrected by the use of laxatives. In bottle-fed infants, the nature of the food which the infant is getting must be ascertained. As a rule, it will be necessary to increase the amount of fat by the addition of cream, or by the administration of a few drops of cod-liver oil two or three times in the day. The use of pure sterilised milk in these cases is often of advantage, as it causes a large increase in the size of the stool, and so increases peristalsis. If sterilisation has been previously effected by boiling this practice should be stopped, and the infant given either pure unsterilised milk—if the supply is trustworthy, or the milk sterilised in the manner we have already described. The effect of boiling is always prejudicial.

If these measures are insufficient, constipation may be relieved by rectal stimulation, as by the use of enemata or small suppositories. These measures are unlikely to have permanently good effects, save in cases in which the cause of the constipation is to be found in feebleness of the expulsive powers of the rectum. In such cases, enemata of one to two ounces of soap and water, half an ounce of olive oil, or a drachm of glycerine, or suppositories made of soap or of a small cone of oiled paper, are of use. Glycerine has a powerful effect, but its continued use may cause irritation of the rectal mucous membrane, as also, though to a less degree, does the continued use of soap.

The use of drugs is, as Holt says, the least important part of the treatment of chronic constipation, and this remark applies as well to infants as to older children. In many cases, the value of an occasional laxative or purgative is considerable, and its administration is always necessary when the infant has been constipated for some time, but its habitual use is most prejudicial, and is a confession that the system of feeding has broken down. Of the various drugs in general use, the least harmful are perhaps the Syrup of Senna in doses of a half to one teaspoonful, and Phosphate of Soda in doses of three to five grains. For long-continued use, or in cases which do not respond to the aforementioned drugs, Cascara Sagrada in from one to five minim doses, sweetened by the addition of a few drops of glycerine, is useful. Castor oil is always contra-indicated in cases of simple constipation, as so far from relieving, it tends to promote the condition.

Diarrhœa.—We are here concerned with diarrhœa the result of acute intestinal indigestion, brought on by improper or impure food. Although this form of indigestion is a preventable disease, it is one of the commonest causes of infant morbidity and mortality.

Ætiology.—Acute intestinal indigestion may occur in breast-fed infants, but it is very much more common in the case of those who are artificially fed. In the former case, a toxic condition of the milk may result from septic or from other acute febrile diseases of the mother and from severe mental emotions, or the amount of proteid contained in the milk may be so great that undigested masses are left in the stomach or intestines and give rise to irritation. Such irritation is also especially prone to occur in the case of artificial feeding, and in addition the risks of the ingestion of toxic milk by the infant are greatly increased. The commonest cause of diarrhœa in bottle-fed infants is the administration of sour milk due to a defective milk-supply or to the use of dirty bottles. There is no doubt that some infants are more prone to diarrhœa than others, and that, in such, a smaller variation from the normal in the food, or a slighter degree of toxicity of the milk, will be sufficient to cause trouble. Similarly, if an infant has once had an attack of 'green diarrhœa,' it will be prone to future attacks.

Symptoms.—The characteristic appearance of the motions in these cases is described by the term 'green diarrhœa.' The stools vary in colour from a bright grass-green to a dark greenish-brown, and usually contain mucus and whitish lumps, consisting of masses of undigested proteid or fat. The number of motions in the day varies from five or six to a practically continuous diarrhœa. As a rule, vomiting also occurs, and the infant vomits up sour-smelling and curdled masses. If these symptoms have continued for some days, the appearance of the infant becomes greatly altered, its face and limbs are wasted, its appearance anxious and 'aged,' and its eyes large and staring. It is extremely irritable, and cries frequently as if in pain. Convulsions, twitchings, and temporary rigidity of the limbs and trunk muscles occur in the later stages, and in the worst cases the appearance of the infant may at times suggest that death has occurred. Even such cases, however, may recover under suitable treatment.

Treatment.—The prophylactic treatment of green diarrhœa consists in careful attention to the nature of the food and to the manner in which it is given. A method of feeding which is quite satisfactory with one infant may be unsuccessful with another. If a breast-fed baby suffers from diarrhœa and does not gain in weight, and if the usual methods, which we are about to describe, have not the desired effect, it is better to stop the mother nursing, and to resort to a wet-nurse or to artificial feeding. The longer the unsuitable food is continued, the more difficult it will be to bring the gastro-intestinal tract back to a normal condition. Similarly, in the case of a bottle-fed infant, if the diarrhœa cannot be checked, the food must be changed at once. If the change from one artificial food to another does not bring about a speedy improvement, the employment of a wet-nurse is imperative.

The only rational medicinal treatment in these cases consists in the administration of purgatives, with the object of removing all curdled and decomposing masses from the intestinal tract, of intestinal antiseptics, and lastly, if necessary, and if we are sure that all offending matter has been removed, of intestinal sedatives. The latter are, however, directly contra-indicated as long as fermenting and irritating masses are retained. In all cases, we commence with the administration of castor oil in half to one drachm doses, repeated if necessary. This, if associated with the necessary alteration in the food, is usually sufficient. If it is not sufficient, the repeated administration of small doses of grey power or of calomel, either alone or in association with salol, may be tried. A suitable prescription in such cases for an infant in the first three months is as follows:—

℞ Hydrarg. c. Cretâ - - - gr. ¼
Salol - - - - - - gr. ½
Sacchari Lactis - - - - *ad* grs. 2.

One of these powders may be given night and morning, and
similar powder from which the grey powder has been omitte
may be given every sixth hour. If the intestinal tract has bee
emptied, but frequent motions consisting mainly of mucus an
perhaps of a little blood continue, minute doses of Dover's powde
may be given, or if the possible effect of the opium is dreaded
subnitrate of bismuth, chalk mixture, or even small doses of th
tincture of the perchloride of iron. At the same time all foo
may be peptonised, in order to assist the weakened action of th
gastric juice. If the diarrhœa resists these measures, or if th
infant is in a condition of marasmus, the employment of a wet
nurse is imperative, and, in many cases, offers the only prospec
of saving the life of the infant. In cases of extreme marasmus
stimulants such as brandy or champagne must be given wit
comparative freedom, in small doses well diluted and frequentl
repeated.

THRUSH.—Thrush, like constipation and diarrhœa, is in-
timately connected with a faulty system of feeding. It is a
parasitic stomatitis, which is characterised by the appearance o
white patches on the tongue, palate, or buccal mucous membrane
The invading fungus is usually stated to be the *Oidium Albicans*, bu
according to Holt this is not the case, and the fungus belongs t
the groups of saccharomyces, and so is termed the *Saccharomyce*
Albicans. The infection, as a rule, comes from a dirty bottle or nipples, and, consequently, thrush may occur in the case of either a breast- or a bottle-fed infant. The spores of the fungus lodge between the epithelial cells, and thence gradually extend so as to form a white patch on the surface of the mucous

membrane. The diagnosis is readily made from the appearance of these patches, or if a little of the patch is gently scraped away and placed upon a slide with a drop of Liquor Potassæ, the threads of the fungus are easily seen with a low power of the microscope.

Symptoms.—The symptoms which accompany thrush, other than those of a slightly irritating stomatitis, are generally due to an accompanying gastro-intestinal irritation brought about by impure food. Accordingly, thrush is frequently found in association with green diarrhœa and vomiting. It is not in itself a dangerous condition, and the debility of the infant with which it is associated is rather the favouring factor, which permits the development of the fungus, than the consequence of its presence.

Treatment.—The treatment is essentially prophylactic, as in the case of diarrhœa, and consists in attention to the purity of the food and the cleanliness of the bottles through which the food is administered. Also, the nipples of the mother should be washed before nursing, and the mouth of the infant should be gently washed out after feeding with a soft piece of old linen and warm water. If thrush occurs in spite of, or rather for want of, these precautions, it is easily cured by the application of any mild antiseptic mouth-wash, such as a little glycerine of borax, or boric lotion.

ICTERUS NEONATORUM

Icterus neonatorum is the term applied to jaundice occurring in the newly-born infant.

Ætiology.—Icterus in the new born, as in the adult, is a symptom of several different conditions. The severe form, which is known as grave or malignant icterus, is the result of extensive disease of the liver or of the bile-ducts, and so is found in syphilitic hepatitis, in septic infection travelling through the umbilical vessels, and in congenital malformations of the bile-ducts. This form is fortunately rare, and is in most cases incurable. The common form of icterus, with which we are here concerned, is that known as ***physiological*** or ***idiopathic icterus.*** It occurs in about sixteen per cent. of infants, as is shown by statistics compiled by Purefoy* at the Rotunda Hospital. Its causation is obscure, and many theories have been brought forward to account for it. Of these, the one most generally received is that advanced by Silbermann, to the effect that the icterus is hepatogenous in origin and is due to the resorption of bile, this resorption being favoured by the stasis of bile in the capillary bile-ducts, the result of their compression after birth by the dilated portal vein and hepatic blood capillaries. The amount of bile-pigment in the liver is also increased, owing to the breaking down of large quantities of red blood corpuscles.

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* Reports of the Rotunda Hospital, *Trans. Roy. Acad. of Medicine in Ireland*, vol. xviii., 1900, p. 277.

Treatment. — Simple icterus calls for no treatment. If the bowels are confined, one or two grains of phosphate of soda may be given.

4 ACUTE INFECTIVE DISEASES

OPHTHALMIA NEONATORUM.—Ophthalmia in new-born infants is usually the result of infection of the eyes during the passage of the head through the vagina. It may also occur after birth as a result of infection conveyed by the fingers of the nurse or mother. As a rule, it is due to the inoculation of the gonococcus, but more rarely it may be due to some of the other forms of pyogenic bacteria. The symptoms commence about two days after infection, and consist of swelling of the lids, injection of the conjunctiva, and profuse purulent discharge. The later consequences of the infection may be ulceration of the cornea, and subsequent opacities leading to partial or complete loss of vision.

Treatment.—Prior to the introduction of prophylactic measures by Credé, the frequency of ophthalmia, especially in hospital practice, was considerable. Since the introduction of these measures, it is a comparatively unknown affection. In hospital practice, careful prophylaxis should be adopted as a routine measure, and in private practice also when there is any reason to suspect the presence of gonorrhœal infection in the mother. It consists in first carefully wiping all discharge away from the eyes the moment the head is born, then washing them gently with a little warm water, and finally dropping into each eye one or two drops of a one per cent. solution of nitrate of silver. A twenty per cent. solution of argyrol may be substituted for nitrate of silver, as its germicidal action is as strong and it is less irritating. If infection occurs, the lids must be separated as often as is necessary to prevent the accumulation of pus between them, and the eyes washed out with warm water or with boracic lotion. It may be necessary to do this in the acute stage at intervals of an hour, or even oftener. Also, once a day, a two per cent. solution of nitrate of silver must be dropped into the eyes, and they must be kept bandaged. All contaminated dressings must be carefully burnt to prevent the spread of infection, and the mother should be warned of the dangerous nature of the discharge. If only one eye is infected, the greatest care must be exercised to prevent the extension of the infection to the other eye, and the latter should be covered by a carefully applied hermetic bandage.

UMBILICAL INFECTION.—The umbilical wound may readily become the seat of pyogenic infection, either before or subsequent to the separation of the funis. In such cases, the infection may remain local and give rise to an omphalitis—*i.e.*, an inflammation of the cellular tissue and skin about the umbilicus; it may involve the walls of the umbilical vessels and extend to the liver, causing an acute hepatitis or phlebitis of the branches of the portal vein; it may extend into the peritoneal cavity, giving rise to peritonitis; or, it may be the starting-point of a general pyæmia.

Treatment.—The treatment of omphalitis consists at first in the application of hot antiseptic compresses. Later, if abscesses form, they must be immediately evacuated. The strength of the infant must be carefully maintained, and the administration of stimulants will usually be required. Hæmorrhage from the ulcerated umbilical vessels is most difficult to check, as any methods of compression, which may temporarily check the bleeding, will, as a rule, lead to fresh sloughing, and so to a return of the hæmorrhage. This remark also applies to the use of perchloride of iron. If the bleeding is slight, a folded pad of iodoform or sterilised gauze is pressed against the bleeding-point. The skin at each side of the umbilicus is then drawn in a fold over this pad, and held there by firmly-applied strips of adhesive strapping. If this fails to check the hæmorrhage, the best prospect of success is offered by nipping up the abdominal wall, and passing a long needle from side to side beneath the vessels; against this needle they can be compressed by a figure-of-eight ligature passed tightly round its projecting ends. The use of plaster of Paris as a method of plugging the umbilical fossa has occasionally been found successful.

Prognosis.—The prognosis in these cases is bad even when the infection remains local, and when it becomes generalised it is almost hopeless.

The appearances of the abdominal wall, when omphalitis is present, are similar to those of cellulitis elsewhere, and consist at first of redness, swelling, and induration around the umbilicus. Later, abscesses form in the cellular tissue. These may discharge externally and the infection wear itself out, or extensive sloughing may occur leading to the formation of a large ulcer. During this process, the umbilical vessels may be re-opened, and hæmorrhage occur.

MASTITIS.—A slight amount of secretion resembling milk is often found in the breasts of newly-born infants of both sexes. De Sinéty has shown that the mammary gland of the newly-born contains spaces lined with secreting cells, which resemble those found in the adult. If the breast is not irritated, this secretion usually ceases in a week or ten days. Occasionally, however, in consequence of want of cleanliness, or of injury produced by attempts on the part of the nurse to express the secretion, infection occurs, and mastitis results. This may get well in a day or two, or may result in the formation of a mammary abscess. The diagnosis of the latter condition is easy.

Treatment.—If the infection is slight and pus has not formed, the application of a hot antiseptic compress is usually sufficient. If pus forms, a small incision must be made, the pus evacuated, and the opening kept patent for a day or two by means of a small plug of iodoform gauze. As a rule, the condition rapidly gets well.

5 TRAUMATA DURING BIRTH

The various traumata which may occur during birth can be divided into three groups:—Fractures, Hæmorrhages, and Nerve Lesions.

FRACTURES.—Fractures of the limbs or clavicles are of occasional occurrence during the operative delivery of the infant. Fracture of the clavicle or humerus is especially prone to occur during attempts at bringing down the arms, when extended beside or behind the after-coming head. Fracture of the femur is more rare, but may occur during the extraction of an impacted breech. Fractures of the bones of the skull are of still rarer occurrence. They can occur in consequence of the force by which the head is compressed between the contracting uterus and the pelvic brim in cases of pelvic contraction, or they may be the result of delivery by the forceps or of the forcible extraction of the after-coming head.

Treatment.—Fractures of the clavicle unite readily, and all that is required is to keep the upper arm bandaged to the side of the chest. Fractures of the humerus may be similarly treated, the lower arm also being fixed, or small splints may be applied to the sides of the fractured bone. In fractures of the femur, the leg may be fixed rigidly by means of an extemporised long splint, or as Credé recommends, the limb may be maintained in a position of complete flexion alongside the body, by means of a bandage round the body and the popliteal space. It should be kept in this position for about fifteen days. This method has the advantage of saving the constant removal of soiled bandages. Fractures of the skull are usually depressed. If caused by the pelvic brim, they are, as a rule, situated on the posterior parietal bone. Any of the cranial bones may be broken by the forceps. If intra-cranial hæmorrhage does not occur, the prognosis is good. No special treatment is required, save under the rarest circumstances, as for instance where a depressed fracture is associated with symptoms of compression of the brain.

HÆMORRHAGES.—The important hæmorrhages, which result from traumata during labour, occur in the form of hæmatomata, and not as free or external hæmorrhage. The two chief seats of such hæmatomata are beneath the pericranium, and in the substance of the sterno-mastoid muscle.

Cephalhæmatoma.—A cephalhæmatoma is the term applied to a blood tumour which forms beneath the periosteum of the cranial bones, as the result of the rupture during labour of a small vessel in this situation. As a rule, it is single, and is found over the presenting bone, but cases of two or even three distinct hæmatomata have been recorded, each situated over a different bone. In the case shown in Fig. 467, a large hæmatoma formed over each parietal bone after a normal labour. Cephalhæmatoma is a rare condition. It occurs in both normal and difficult labours, and while its occurrence is probably favoured by delay or by traumata, it may also occur apparently quite independently of these conditions. In such cases, it may be due to increased blood pressure, to changes in the external table of the cranial bones, or to an altered condition of the blood.

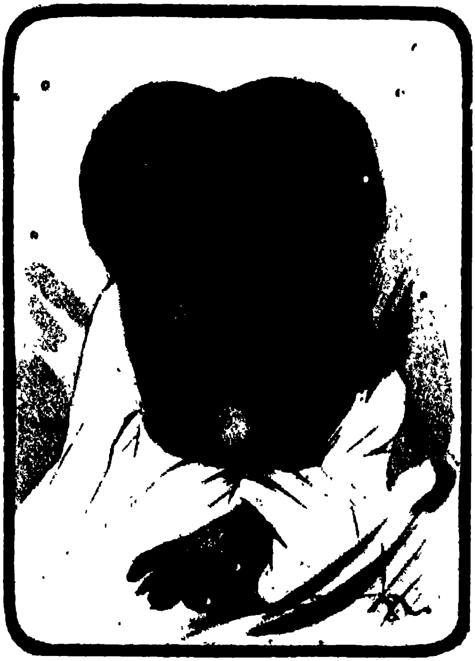

FIG. 467.—A DOUBLE CEPHALHÆMATOMA.
(From a photograph of an infant born in Dr. Steevens' Hospital.)

The appearance of a cephalhæmatoma is at first very much the same as that of a caput succedaneum, save that the edges of the swelling are more clearly outlined. On closer examination, these edges are found to be co-terminous with the bone over which the tumour is situated, and this limitation is more noticeable after a few days than it is at birth, in consequence of the gradual disappearance of the accompanying caput succedaneum. At first, the hæmatoma consists of a tense swelling in which fluctuation can be obtained. Later, as the blood coagulates, the periphery of the swelling becomes of bony hardness, while the centre is depressed and soft. In some cases, a crackling sensation is experienced, due perhaps to the formation of minute bony plates on the inner surface of the periosteum (Holt). Later still, the peripheral hardness extends centripetally, until the entire swelling becomes hard. At the same time it gradually lessens in size, and finally disappears. In the case shown in Fig. 467, in which the hæmatomata were of large size, the swellings did not commence to diminish notably in size until the third week after birth. They had almost completely disappeared by the sixth week. Suppuration seldom occurs, and, when it does, abrasions of the skin over the swelling are usually present, and through these infection has occurred. No treatment is required unless suppuration occurs, as, if left alone, the blood will be gradually absorbed. If suppuration occurs, the resultant abscess must be opened and drained.

Hæmatoma of the Sterno-mastoid.—Hæmatoma of the sterno-mastoid is a condition which is of interest from its rarity, but is of no great clinical importance. The traumatism, to which it is due, occurs during birth, but the existence of the hæmatoma is usually not recognised until ten days or more afterwards, that is, until the coagulated blood is firm enough to cause a distinct tumour. It usually occurs in association with pelvic presentation, but may also be found after forceps application in head presentation, and is said to be due to over-twisting of the head producing a laceration of a bloodvessel in the muscle, and, in some cases, laceration of the muscle fibres themselves. The tumour is usually about the size and shape of a pigeon's egg, and resembles an enlarged lymphatic gland. It is movable, hard, and obviously situated in the belly of the muscle. If it is of a very large size, and associated with an extensive laceration of the muscle fibres, it may possibly give rise to a subsequent torticollis. The condition calls for no special treatment, though gentle massage may promote the absorption of the blood.

NERVE LESIONS.—The nerve lesions which result from injuries during birth may be divided into two groups:—central lesions and peripheral lesions.

Central Lesions.—Central lesions are much more serious than are peripheral lesions and are also rarer. They usually occur as meningeal hæmorrhages, either localised or spread over the entire surface of the brain, as a result of which partial or complete hemiplegia is found. Convulsions also are common, and so are disturbances of the respiratory and cardiac functions. Death, as a rule, results within the first four or five days, but in some cases may not occur for weeks, months, or even years. Treatment is of little avail.

Peripheral Lesions.—Peripheral nerve lesions are considerably more common than are central lesions, and are of interest from the point of view of the prognosis. The most common lesions are those of the facial nerve, and of the upper trunks of the brachial plexus. Facial paralysis is of not uncommon occurrence after delivery by the forceps, in consequence of the compression of the facial nerve at the point of emergence from the cranial cavity. The paralysis is, as a rule, unilateral, and may be noticed an hour or so after the infant is born, or not for a day or two. When the infant is asleep, the eye on the affected side is open, in consequence of the paralysis of the orbicularis palpebrarum muscle. This contrasts with the appearance of the infant in facial paralysis of central origin, in which the orbicularis muscle usually escapes. When the infant cries, the unaffected side of the face puckers up, while the paralysed side remains smooth, and the mouth is drawn to the unaffected side. As a rule, the condition disappears in a day or two, or, in some cases, may last for a few weeks. Occasionally, the lesion may be more severe, and the reaction of degeneration be present. In such cases, the regular use of the galvanic current will be necessary. The eye on the paralysed side must be watched, and care taken that it does not suffer from the exposure which results from paralysis of the lid.

Paralysis of the upper extremity, as described by Erb, is usually the result of lesions of the fifth and sixth cervical nerves, and so is confined to a certain group of muscles. These are the deltoid, the biceps, the supinator longus, the brachialis anticus, and sometimes the supra- and infra-spinatus. The cause of the lesion is probably to be found in undue traction on the nerves on one side in consequence of the head being drawn over too far towards the opposite shoulder (Fieux*), as may occur during traction on the head with the forceps, or with the hand when delivering the shoulders, or when bringing down arms extended beside the after-coming head. Erb, on the other hand, after whom this form of paralysis is usually named, considers that it is due to pressure exercised by the fingers or forceps on 'Erb's spot'—a point on the neck at which electrical stimulation causes the contraction of all the muscles usually involved in Erb's paralysis. In consequence of the paralysis, the arm hangs lifelessly by the side. It is rotated inwards, the forearm pronated, and the palm looking outwards. In severe cases, the reaction of degeneration is present. The majority of cases recover within two or three months, the improvement commencing in the biceps and ending in the deltoid. According to Holt, spontaneous recovery is not to be looked for unless it occurs within this time. In severe cases, permanent paralysis may result. The treatment of Erb's paralysis consists in the regular and persistent use of the galvanic current, or of the faradic current if the muscles react to it.

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* 'De la Pathogénie des Paralysies brachiales chez le Nouveau-né,' *Ann. de Gynéc.*, January, 1897.

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